U.S. Department of the Interior
Bureau of Land Management

# Parkdale Mineral Materials Competitive Sale

## Draft Environmental Impact Statement

DOI-BLM-CO-F020-2019-0013-EIS

Costs to date to develop analysis are $781,000

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# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| % | percent |
| ACEC | Area of Critical Environmental Concern |
| amsl | above mean sea level |
| AUM | Animal unit month |
| BCR | Bird Conservation Region |
| BLM | Bureau of Land Management |
| btoc | below top of casing |
| CDPHE | Colorado Department of Public Health & Environment |
| CDRMS | Colorado Division of Reclamation, Mining and Safety |
| CEQ | Council on Environmental Quality |
| CESA | Cumulative Effects Study Area |
| CFR | Code of Federal Regulations |
| $CH_4$ | methane |
| CO | carbon monoxide |
| $CO_2$ | carbon dioxide |
| CPW | Colorado Parks and Wildlife |
| CRS | Colorado Revised Statutes |
| CUP | Conditional Use Permit |
| DAU | Data Analysis Unit |
| DMFPD | Deer Mountain Fire Protection District |
| DOI | U.S. Department of the Interior |
| dv | deciviews |
| DWR | Colorado Division of Water Resources |
| EA | Environmental Assessment |
| EIS | Environmental Impact Statement |
| EPA | U.S. Environmental Protection Agency |
| ESA | Endangered Species Act |
| FLPMA | Federal Land Policy and Management Act of 1976 |
| FR | Federal Register |
| ft. | feet |
| GHG | greenhouse gas |
| GIS | Geographic Information System |
| GMS | Growth Media Stockpiles |

| | |
|---|---|
| GMU | Game Management Units |
| gpm | gallons per minute |
| GRAPI | Gross Rent as a Percentage of Household Income |
| HAP | hazardous air pollutant |
| HUC | Hydrologic Unit Code |
| IAPs | Integrated Activity Plans |
| KOP | key observation point |
| MBTA | Migratory Bird Treaty Act |
| MM | Martin Marietta Materials, Inc. / Martin Marietta |
| MOU | Memorandum of Understanding |
| $N_2O$ | nitrous oxide |
| NAAQS | National Ambient Air Quality Standards |
| NEPA | National Environmental Policy Act of 1969 |
| NHD | National Hydrology Data |
| NLCD | National Land Cover Data |
| $NO_2$ | nitrogen dioxide |
| NOA | Notice of Availability |
| NOI | Notice of Intent |
| NPDES | National Pollutant Discharge Elimination System |
| NRHP | National Register of Historic Places |
| OHV | off-highway vehicle |
| PILT | payment in lieu of taxes |
| PLSS | Public Land Survey System |
| $PM_{10}$ | particulate matter less than 10 microns in diameter |
| $PM_{2.5}$ | particulate matter less than 2.5 microns in diameter |
| PSD | Prevention of Significant Deterioration |
| RFFA | Reasonably Foreseeable Future Action |
| RGFO | Royal Gorge Field Office |
| RMP | Resource Management Plan |
| ROD | Record of Decision |
| ROW | right-of-way |
| Sale Area | Mineral Materials Sale Area |
| SHPO | State of Colorado Historic Preservation Office |
| SMOCAPI | Selected Monthly Owner Costs as a Percentage of Household Income |

| | |
|---|---|
| SMP | Stormwater Management Plan |
| $SO_2$ | sulfur dioxide |
| SPCC | Spill Prevention, Control, and Countermeasures |
| U.S. | United States |
| U.S.C. | United States Code |
| USCB | United States Census Bureau |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| VRI | visual resource inventory |
| VRM | Visual Resource Management |

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# CHAPTER 1. INTRODUCTION

## 1.1. INTRODUCTION AND BACKGROUND

Martin Marietta Materials, Inc. (Martin Marietta) has submitted an application to the Bureau of Land Management (BLM) for a 100-year competitive contract for the sale of mineral materials. The proposed 100-year materials sale contract would be subject to BLM review and renewal after each 10-year period during the life of the contract. The proposal would permit Martin Marietta to expand operations from its existing privately-owned Parkdale Quarry onto adjacent BLM-administered lands and provide access to 400 million net tons of aggregate. The existing Parkdale Quarry is located in Fremont County, Colorado, approximately 12 miles west of the Town of Cañon City, Colorado (Figure 1.1-1, Appendix A). It is situated on the north side of the Arkansas River and United States (U.S.) Highway 50 in portions of Township 18 South, Range 72 West, sections 1, 2, 11, 12, and Township 18 South, Range 71 West, sections 6 and 7 (6th Prime Meridian). The proposed expansion area includes the Mineral Materials Sale area (Sale Area), which encompasses approximately 1,458 acres of public land administered by the BLM Royal Gorge Field Office (RGFO) (Figure 1.1-2, Appendix A). Proposed mineral material extraction within the 1,458-acre Sale Area would be limited to approximately 698 acres, and the remaining 760 acres would serve as a perimeter buffer for which no surface disturbance is proposed. The BLM prepared this Environmental Impact Statement (EIS) to analyze the impacts associated with the proposed mine expansion.

Under the Proposed Action, most of the supporting operations for the mine, such as mineral processing, loadout, and transportation, would continue on Martin Marietta's private land. The Proposed Action includes the following activities within the mine expansion area over the estimated 100-year life of the quarry:

- Construction of approximately 1.1 miles of access road;
- Excavation of mineral materials using safe, controlled blasting methods and heavy-duty excavation equipment;
- Loading of mineral materials onto haul trucks and/or an overland conveyor system for transport to the processing facilities on the adjacent private land;
- Reclamation of disturbed areas in accordance with Martin Marietta's reclamation plan.

Over 95 percent of the mineral materials to be processed at the quarry would continue to be transported by the existing Rock & Rail or Union Pacific railroads for delivery to customers and markets in southeastern Colorado and southwestern Kansas. Less than 5 percent of the mineral materials processed would be transported by truck to local markets within 50 miles of the quarry.

Placeholder (Figure 1.1-1)

Placeholder (Figure 1.1-2)

# 1.2. BLM PURPOSE AND NEED

The purpose of this action is to respond to a request by Martin Marietta to obtain a renewable competitive contract for the sale of mineral materials located immediately adjacent to the existing Parkdale Quarry in Fremont County, Colorado.

The need is based on the BLM's multiple-use mission, set forth in the Federal Land Policy and Management Act of 1976 (FLPMA), which mandates that the public land resources be managed for a variety of uses, including mining. Per 30 U.S. Code (U.S.C.) 1602, the project would, "assist in the pursuit of measures that would assure the availability of materials critical to commerce, the economy, and national security" and "facilitate availability and development of domestic resources to meet critical materials needs."

# 1.3. DECISION TO BE MADE

The BLM will decide whether to approve the application and issue a renewable competitive contract for the sale of mineral materials in the mine expansion area, using the analysis contained in this EIS. Completion of this EIS does not constitute the final approval for the Proposed Action.

# 1.4. RELATIONSHIP TO BLM AND NON-BLM POLICIES, PLANS, AND PROGRAMS

## 1.4.1. National and BLM Policies

This EIS is consistent with the National Environmental Policy Act (NEPA) of 1969, as amended, and Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA. These are outlined in 40 Code of Federal Regulations (CFR) Parts 1500-1508 and Department of Interior NEPA regulations at 43 CFR 46. Proposed Mineral Materials Sales located on BLM-administered lands are regulated under 43 CFR Parts 3600-3604.

## 1.4.2. Land Use Plan Conformance

The proposed Mineral Materials Sale Area spans both the Arkansas River and Waugh Mountain/Tallahassee subregions of the Royal Gorge Resource Area Resource Management Plan (RMP). The Proposed Action is subject to and has been reviewed for conformance with the following plan (43 CFR 1610.5, BLM 1617.3):

Name of Plan: Royal Gorge Resource Management Plan, Arkansas River Sub-region

Date Approved: 05/13/1996

Decision Numbers: 1-40, 1-41, 1-42, 1-43, 1-66, 1-67

Decision Language:

> 1-40: "Areas will be . . . available for mineral materials development: administered under existing regulations; limited by closure if necessary; special mitigation will be developed to protect values on a case-by-case basis."
>
> 1-41: "Areas will be . . . available for mineral materials development under standard mineral operating practices."
>
> 1-42: "Areas will be . . . available for mineral materials development under a seasonal limitation through claimant/operator notification to protect: big game critical winter habitat; wild turkey winter habitat; raptor nesting/fledgling habitat; Mexican spotted owl habitat; bald eagle winter roosting habitat; peregrine falcon habitat; ferruginous hawk nesting/fledgling habitat."
>
> 1-67: "These designated Areas of Critical Environmental Concern (ACECs) will receive special management as follows: . . . mineral materials development will not occur."

Name of Plan: Royal Gorge Resource Management Plan, Waugh Mountain/Tallahassee Creek Subregion

Date Approved: 05/13/1996

Decision Numbers: 6-14, 6-20, 6-30, 6-35, 6-36, 6-37, 6-38, 6-65,

Decision Language:

> 6-14: "Conflicts between wildlife habitat and other uses e.g., grazing, mineral development, etc., will be resolved in favor of achieving vegetation management goals."
>
> 6-20: "Mineral operations will be available with timing limitations for:
>
> - big game critical winter habitat;
> - raptor nesting and fledging habitat;
> - wild turkey winter habitat."
>
> 6-35: "Areas will be open to mineral entry and available for mineral materials development:
>
> - administered under existing regulations;
> - limited by closure if necessary;
> - special mitigation will be developed to protect values on a case-by-case basis."
>
> 6-36: "Areas will be open to mineral entry and available for mineral materials development under standard mineral operating practices."

6-37: "Areas will be open to mineral entry under timing limitations and available for mineral materials development under a seasonal limitation through claimant/operator notification to protect:

- big game critical winter habitat;
- wild turkey winter habitat;
- Mexican spotted owl habitat;
- ferruginous hawk & raptor nesting/fledging habitat."

6-38: "Areas will be closed to mineral entry and mineral materials development to protect:

- big game birthing habitat;
- fishery habitat;
- perennial riparian areas;
- portion of one ACEC."

6-65: "Visual Resource Management class criteria will be used as a guide for other resource management actions."

### 1.4.3. State and Local Land Use Plans and Policies

The Colorado Land Reclamation Act for the Extraction of Construction Materials (Colorado Revised Statutes [CRS] Title 34 Article 32.5-101 through 125) regulates the operations of all existing and new mining operations that extract construction materials, and the act recognizes that the extraction of construction materials and the reclamation of land affected by such extraction are necessary and proper (34-32.5-102). The Colorado Division of Reclamation, Mining and Safety (CDRMS) is tasked with carrying out these requirements. In the event the proposed material Sale Area or an actionable alternative on BLM-administered land is approved, CDRMS requirements would be implemented in conjunction with BLM requirements. The currently active Parkdale Quarry on private lands operates under CDRMS Permit # M1997054.

The Fremont County Master Plan, originally developed in 2002 and revised in 2015, encourages responsible mining operations that result in the least impacts possible (Fremont County 2015). The Proposed Action is consistent with the goals, objectives, and strategies related to mining and land use policy of the 2015 Fremont County Master Plan.

## 1.5. PERMITS AND APPROVALS

In addition to the EIS, implementing the BLM selected alternative would require authorizing actions from other federal, state, and local agencies with jurisdiction over certain aspects of the proposed project. Table 1.1 lists the major authorizations already in place that will need to be amended or new authorizations that will be required. Martin Marietta is responsible for amending existing permits and applying for and acquiring additional permits and approvals, as needed.

**Table 1.1. Major Permits and Approvals**

| Permit/Approval | Granting Agency |
|---|---|
| Enforce the Federal Mine Safety and Health Act of 1977 | Mine Safety and Health Administration (MSHA) |
| Regular 112 Operation Reclamation Permit | Colorado Division of Reclamation, Mining and Safety (CDRMS) |
| Air Quality Construction Permits | Colorado Department of Public Health and Environment (CDPHE), Air Pollution Control Division |
| Sand & Gravel Mining Wastewater & Storm Water Combined Permit | CDPHE, Water Quality Control Division |
| Conditional Use Permit | Fremont County |
| Construction Applications/Building Permits | Fremont County |
| Spill Prevention, Control, and Countermeasures Plan | U.S. Environmental Protection Agency (EPA) |
| General Permit for Sand and Gravel Mining and Processing | Colorado Discharge Permit System |

## 1.6. PUBLIC INVOLVEMENT

The BLM published a Notice of Intent (NOI) to prepare this EIS in the *Federal Register* on July 31, 2019. The NOI initiated a 30-day formal scoping period during which the BLM solicited input from the public on the issues and impacts to be addressed in this EIS. A public meeting was held at Abbey Events Center in Cañon City on August 15, 2019. Substantive public comments, which are summarized in the Parkdale Quarry Expansion EIS Final Scoping Report, were considered in the preparation of this document.

## 1.7. KEY ISSUES

Key issues identified for detailed analysis in the EIS through the internal and external scoping processes are:

### *Air Quality*

- What types and amounts of criteria air pollutants would be emitted as a result of the proposed Parkdale Quarry expansion, and what are the potential effects to ambient air quality in the region?
- What types and amounts of hazardous air pollutants would be released as a result of the proposed Parkdale Quarry expansion, and what are the potential health and environmental effects?

- What types and amounts of greenhouse gases that would contribute to global climate change would be emitted as a result of the proposed Parkdale Quarry expansion?

### Lands with Wilderness Characteristics

- How would the proposed Parkdale Quarry expansion affect the currently inventoried area identified as having wilderness characteristics?

### Social and Economic Conditions

- How would the proposed Parkdale Quarry expansion affect social and economic conditions in Fremont County?

### Water Quality and Quantity (Surface and Ground Water)

- What are the water sources and water requirements for the Parkdale Quarry expansion?
- Is dewatering anticipated to be required in any of the pits?
- How would the Parkdale Quarry expansion affect water quality, quantity, and water rights?
- How would surface water and groundwater be monitored for the proposed mine expansion?

### Wildlife (Terrestrial)

- How would the Parkdale Quarry expansion affect the availability and quality of habitat for bighorn sheep and other terrestrial wildlife species?

### Wildlife (Migratory Birds)

- How would the Parkdale Quarry expansion affect the availability and quality of habitat for migratory birds?

### Wildlife (Special Status Species)

- How would the Parkdale Quarry expansion affect the availability and quality of habitat for federal, state, and BLM RGFO designated special status wildlife and plant species?

### Visual

- How would expansion of the Parkdale Quarry affect the area’s scenic integrity and visual resources as seen from key observation points?

Impacts the BLM determined to be negligible or that would be subject to design features of the alternatives were not brought forward for detailed analysis. Section 3.1, *Introduction*, of this EIS presents information reviewed by the BLM during consideration of issues to be brought forward for detailed analysis.

# CHAPTER 2. DESCRIPTION OF ALTERNATIVES, INCLUDING THE PROPOSED ACTION

## 2.1. INTRODUCTION

This chapter summarizes the alternatives considered for this project, as well as alternatives considered but dismissed from detailed analysis. Alternative A, the Proposed Action, is considered under the Competitive Mineral Materials Sale (COC-078119) at Parkdale as described in the Mining and Reclamation Plan (Mine Plan) for the Parkdale Quarry expansion submitted to the BLM in June 2016 (Martin Marietta 2016). Appendix D of this EIS contains the complete Mine Plan. All alternatives presented in this chapter, were developed based on internal and external scoping input and supporting technical information provided by Martin Marietta and reviewed by the BLM. This chapter also includes a summary of alternatives that were considered but not carried forward for detailed analysis.

## 2.2. EXISTING PARKDALE QUARRY OPERATIONS

The existing Parkdale Quarry is located on approximately 513 acres of private land owned by Martin Marietta (Figure 2.2-1, Appendix C). The existing Parkdale Quarry has been in operation at this location since 1997 under various ownership entities. The quarry was obtained by Martin Marietta in November 2015 from Front Range Aggregates, LLC. The quarry operates under CDRMS Regular 112 Reclamation and Operation Permit #M1997054 and a Conditional Use Permit (CUP) #07-003 from Fremont County. Current authorizations allow for mining and processing during daylight periods only and allow for 24-hour loading of material for transport by rail cars and trucks. The quarry is also permitted by the CDRMS to operate under Regular 112 Reclamation and Operation Permit #M1997054. The existing Parkdale Quarry directly employs approximately 45 full-time employees, in addition to various other sub-contractors and suppliers that support quarry operations. The current Parkdale Quarry Mine has approximately 37 million to 47 million tons of salable permitted reserves in the granite deposit on Martin Marietta's property. Martin Marietta is currently permitted by Fremont County to conduct mining on 172.5 acres of its privately held lands at the Parkdale Quarry and is permitted by CDRMS to produce up to two million short tons per year from the site (one short ton equals 2,000 pounds).

The quarry consists of two types of deposits located to the north of the Arkansas River: an alluvial deposit south of Tallahassee Creek and a granite deposit northeast of the creek within the private land (Figure 2.2-1, Appendix C). The alluvial reserves originally occupied approximately 100 acres and consisted of materials derived from granitic, gneissic, and amphibolite source rocks. Blasting is not required for mining the alluvial reserves. The alluvial deposit is excavated using a track hoe and placed in haul trucks for transport to the materials processing plant. The material is fed by conveyors to a jaw crusher, followed by a cone crusher, and then screened to achieve the desired size fractions: ¾ inch, ½ inch, and $^3/_8$ inch crushed stone; sand; and crushed

Placeholder (Figure 2.2-1)

fines material. Another product is coarse concrete aggregate. A portion of the material is fed through a wash plant to remove fine material and dust. The alluvial deposit has been substantially depleted as of 2019.

The granite deposit is an approximate 65-acre permitted hard rock mining deposit located northeast and across Tallahassee Creek from the alluvial deposit. Mineral material recovery at the existing granite quarry uses a hillside excavation technique with benches of 30 to 40 feet in height depending on site characteristics. Topsoil at the site is stripped prior to excavation and is stored in growth media stockpiles (GMS) at various locations across the existing quarry for use in post-mining reclamation activities. Once topsoil is removed and the underlying rock material is exposed, the rock formations are fractured using explosives. All in-ground blasting work on the existing site is conducted by a licensed blaster and no explosive materials are currently stored onsite.

Once rock formations have been fractured, an excavator is used to load the material onto haul trucks for transport to the onsite processing facility. The processing of materials for the granite quarry is similar to the processing for the alluvial quarry. The processing facility consists of a series of mechanical rock crushers that pulverize the rock material into specific grain sizes used in road building and other construction industries. Once the rock material is processed, it is transported to local markets via either the existing railroad system or by truck. Approximately 95 percent of all material produced from the existing quarry is shipped via rail (Resource Economics 2019). Currently, the Parkdale Quarry's operations result in three to five trains per week with approximately 48 cars per train as well as approximately 28 trips per day of 12-ton haul trucks. Aggregate produced is shipped for concrete and asphalt products.

Existing ancillary and operations support facilities located on the Martin Marietta owned private parcel include the quarry administration offices, employee facilities, equipment repair and maintenance shops, the railroad loadout facility, six water retention ponds, storage buildings, and a scale house. Electrical power is provided to the site via overhead distribution lines through the existing grid operated by Black Hills Energy Corporation or by mobile diesel electric generators.

Martin Marietta implements on-site water conservation measures to reduce water consumption during operations and a substantial portion of the current annual water use rate includes recycled water. Martin Marietta has existing water rights or supply agreements for augmentation water to obtain water for aggregate processing from tributary groundwater that collects in the alluvial pit and augmented as needed from Tallahassee Creek. Stormwater and excess groundwater are captured in settling ponds on site and are not discharged to Tallahassee Creek until water quality meets National Pollutant Discharge Elimination System (NPDES) permit limits. No chemicals are used in aggregate processing.

Reclamation of the site will be completed according to the existing Reclamation Plan and as required by the Parkdale Quarry Regular Operation 112 and Reclamation Permit #M-97-054 approved by the State of Colorado Division of Reclamation, Mining and Safety. Reclamation of the currently authorized facilities is guaranteed by Martin Marietta's existing reclamation bond.

## 2.3. ALTERNATIVE A (PROPOSED ACTION)

The following sections summarize key components of Alternative A, which are detailed in Appendix D, *Mining and Reclamation Plan*.

### 2.3.1. Surface Ownership and Land Disturbance

The Sale Area includes approximately 1,458 acres of public land managed by the BLM RGFO (Figure 1.1-2, Appendix C). Martin Marietta estimates that approximately 400 million tons of aggregate material would be recoverable from the proposed Sale Area. Under Alternative A, mining and extraction of rock materials is anticipated to disturb approximately 698 acres of the project area. The remaining 760 acres of the project area would remain undisturbed serving as a perimeter buffer zone to minimize impacts to resources adjacent to the project area (Figure 2.2-2, Appendix C). Only areas under active mining would be fenced.

### 2.3.2. Mining

Mining activity would progress under five phases over the approximate 100-year life-of-mine and would progress generally from the northwest edge of the Sale Area to the southeast edge. The mine plan area is expected to be fully operational in 2024, the first year of operation, under the Alternative A. Expansion of mining activity at the site would provide long-term viability for the quarry, extending its useful life from the current forecast of 15 to 30 years under Alternative B, the No Action Alternative (depending on production) (Martin Marietta 2019d) to over 100 years into the future.

The five individual phases are referred to as the West Pit, West Central Pit, Central Pit, East Central Pit, and the East Pit as shown in Figure 2.2-1 (Appendix C). The West Pit mine area is anticipated to be fully operational in 2024. The total anticipated acreages of surface disturbance and mining periods for each of the five phases are presented in Table 2.1.

Surface disturbance from mining would be concurrently reclaimed in areas where mining and other activities are complete. During mining operations throughout the five proposed phases, surface disturbance would be limited to the area of active material extraction at any one time and areas undergoing concurrent reclamation. Due to the proposed phased approach to mining and implementation of concurrent reclamation, actual existing disturbance acreages at any one point in time are anticipated to be limited relative to the total acres of proposed disturbance. Although specific acreages of annual disturbance cannot be estimated due to shifts in production, Martin Marietta anticipates that active surface disturbance at any one point would be limited to 100 acres or less.

Under Alternative A, previously authorized mining of the granitic deposit located on Martin Marietta's private lands would cease upon BLM approval and any current disturbance would be reclaimed. However, Martin Marietta anticipates possibly mining some of these private reserves

Placeholder (Figure 2.2-2

later in the 100-year life-of-mine. Under Alternative A, Martin Marietta would move the currently permitted southern mining boundary on private lands further to the north and away from the Arkansas River. This anticipated change in mining boundary would be included in an amendment to Martin Marietta's Fremont County CUP and CDRMS Mine and Reclamation Permit.

Alternative A includes a 100-year expected life-of-mine period if annual production rates were increased to approximately 2,000,000 to 4,000,000 short tons of rock material from the current production rate maximum of 2,000,000 short tons annually. Therefore, mining would proceed at 1,000,000 to 2,000,000 short tons per year during Phase 1 and would increase from 2,000,000 to 4,000,000 short tons per year during phases 2 to 5.

**Table 2.1. Estimated Surface Disturbance and Active Mining Periods for Alternative A Phases**

| Phase Number | Phase Name | Surface Disturbance (acres) | Mining Period[1] (years) |
|---|---|---|---|
| 1 | West Pit | 81 | 15-20 |
| 2 | West – Central Pit | 166 | 20-40 |
| 3 | Central Pit | 228 | 25-50 |
| 4 | East – Central Pit | 110 | 15-30 |
| 5 | East Pit | 113 | 15-25 |
| | **Total** | **698** | **-** |

Source: Martin Marietta 2016

[1] Based on current and future anticipated production rates

## 2.3.3. Materials Processing

Materials processing would continue as described in Section 2.2, *Existing Parkdale Quarry Operations*, and currently authorized at Martin Marietta's privately-owned processing area. The quarry would continue to produce aggregate commodities currently provided, but expand to also provide railroad ballast. Under Alternative A, Martin Marietta would invest an additional $25 to $30 million dollars from 2020 through 2023 to upgrade processing equipment that would allow for increased aggregate production including the production of railroad ballast.

## 2.3.4. Haul and Access Roads

Approximately 1.1 miles of new haul road designed to be consistent with BLM and industry standards would be constructed on BLM-administered lands along the southwestern border of the Sale Area leading from the proposed pit areas to the existing materials processing area (Figure 2.2-2, Appendix C). The haul road would include a running width of 60 feet to allow vehicles to safely pass.

## 2.3.5. Ancillary and Support Facilities

Ancillary and support facilities would remain the same as described in Section 2.2, *Existing Parkdale Quarry Operations*, and currently authorized at Martin Marietta's privately-owned processing area.

### 2.3.5.1. Site Security, Signs, and Fencing

To preclude public access for safety, active mining areas would be signed and/or fenced according to any requirements under the current Parkdale Quarry CDRMS operating permit, the current Fremont County CUP and BLM requirements based upon future site conditions. Areas where mining has yet to occur or where mining and reclamation activities are complete would not be fenced. Public access locations to the proposed Sale Area and adjacent BLM-administered lands would also be signed to alert the public of mining operations and quarry related traffic. The BLM would monitor public access and safety management throughout the life of the quarry and may require the implementation of other safety measures including increased signage, fencing, and site security personnel or equipment.

### 2.3.5.2. Rail Transport of Aggregate Materials

Under Alternative A, Martin Marietta estimates that rail transport of aggregate material would increase proportionally with overall production rates. In 2024, Martin Marietta estimates that production of 1,807,000 tons of aggregate material would require the addition of one to three trains per week to meet market demand. In addition, the length of loaded trains would be increased from 48 cars per train to approximately 90 cars per train.

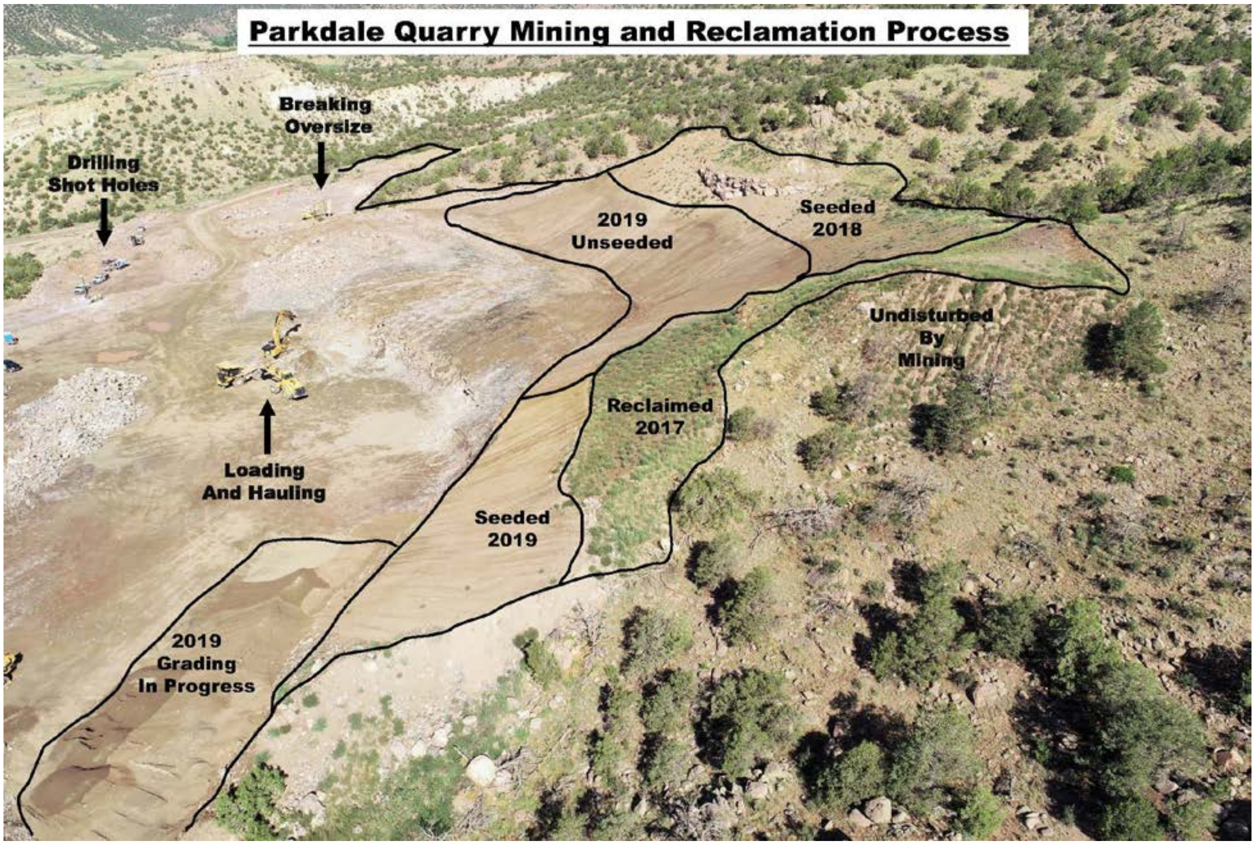
## 2.3.6. Growth Media Stockpiles (GMS)

Topsoil and growth media management under Alternative A would remain consistent with the requirements under the current Parkdale Quarry CDRMS operating permit and Fremont County CUP. Topsoil would be stripped from mining areas prior to blasting and rock excavation and placed in various locations as GMS for use during reclamation. GMS that is not anticipated to be used within six months of excavation would be seeded to establish a vegetative cover for stabilization and protection from erosion.

## 2.3.7. Closure and Reclamation Plan

Appendix D contains the complete mine closure and reclamation plan for the Sale Area. The goal for final reclamation of the mining area would be to create a topographic and ecological setting that is similar to that of the lands located south of the existing Parkdale Quarry and the Arkansas River. These lands are characterized by grassland vegetation communities in the flat valley bottom and pinyon-juniper communities along the rugged hillsides surrounding the valley. Concurrent reclamation of mine areas for which mining has been completed would be implemented, resulting in a diversity of vegetation communities over the proposed 100-year mine life. Reclamation would be conducted in accordance with the Mine and Reclamation Plan on file with the BLM (Appendix D), requirements of existing CDRMS and Fremont County permits, identified design features, and BLM materials sale contract requirements. Exhibit A presents an infographic depiction of current mining and reclamation at the existing Parkdale Quarry. The areas noted in Exhibit A as reclaimed, seeded, unseeded, or where grading is in progress were generally mined in the 24-month period prior to the initiation of reclamation grading and seeding. Martin Marietta anticipates reclaimed areas within the Sale Area would be similar to those areas identified in Exhibit A as having completed reclamation.

**Exhibit A. Mining and Reclamation at the Parkdale Quarry[1]**



Source: Martin Marietta 2019a.

[1] Areas in various stages of reclamation: Reclaimed 2017 was mined in 2016-2017; Seeded 2018 was mined in 2017-2018; Seeded 2019 was mined in 2018-2019; Unseeded 2019 was mined in 2019; 2019 Grading in Progress was mined in 2019.

Although the current proposed Mine Plan does not include any above ground structures, final closure and reclamation of disturbance within the Sale Area would include the removal of any above ground structures and facilities on BLM-managed lands. All quarry haul and access roads and associated culverts would be removed and reclaimed once mining is complete and the roads are determined to no longer be necessary to support reclamation activity and any post-reclamation monitoring requirements.

Once mining is completed, the resulting topography of the Mine Plan area would generally slope to the south and southwest, and drainage channels would be constructed with similar depth, sinuosity, and cross-sections to natural drainages found to the south of the existing operation. Mining benches would be backfilled and reclaimed once mining is completed using a bulldozer to place and compact fill material to grade. Reclaimed benches would be approximately 35-feet in height, 30-feet in width, and face-angles would be constructed at approximately 80 degrees, resulting in a 1:1 (horizontal to vertical) reclamation slope intended to blend with natural topography as shown in Figure 4 of the Parkdale Mine and Reclamation Plan (Appendix D). Figure 4 of the Mine and Reclamation Plan depicts a single reclamation bench for simplicity. When final reclamation is completed at the end of the life-of-mine, the topography of the reclaimed areas would include a series of reclamation benches from the bottom of the slope to the upper edge of the area of previous disturbance. Some reclamation benches may include steeper slopes and areas of bare exposed rock, intended to provide habitat for Rocky Mountain bighorn sheep (*Ovis canadensis*). These areas would be designed in coordination with the Colorado Department of Parks and Wildlife (CPW) and would be consistent with slope stability designs for the entire Sale Area.

Once reclamation benches are constructed, topsoil placement would occur with soil depths ranging from six to twelve inches, with the overall goal of an average soil depth of nine inches. Existing topsoil depths at the Parkdale Quarry and the proposed Sale Area range from six to 60 inches across various locations (Agile Stone 1997, NRCS 2020). Field investigation of salvageable topsoil volumes for stockpiling during operations and placement as cover during final reclamation are incomplete. Under Alternative A, the BLM would require Martin Marietta to complete an assessment of salvageable topsoil material across the five proposed mine phases and determine the potential need to identify additional soil amendment material to ensure adequate topsoil cover material (see Design Feature REC-003 in Table 2.2 below). Previous and ongoing reclamation activity at the Parkdale Quarry has been completed successfully by Martin Marietta through the use of existing topsoil resources for reclamation purposes.

Final grading of replaced topsoil would be conducted to minimize erosion potential and to maximize soil stability. Once topsoil placement is complete, soil samples would be collected and analyzed by a contract laboratory to identify any necessary fertilizer or amendment applications to support successful revegetation of the disturbed sites. Fertilizers, if necessary, would be applied using a broadcast method that ensures equal application rates across the site. Following application of fertilizers, reseeding would occur using broadcast methods and reclamation seed mixes approved by the BLM. Section 6.4 of the proposed Mine Plan (Appendix D) presents the species and application rates for reseeding of interim GMS stockpiles and the final reclamation seed mix to be applied to disturbed mine and haul road areas.

Completion of final reclamation of disturbance on BLM-administered lands is anticipated to require between five and fifteen years at each mining area across the five proposed phases depending on the location and desired post-reclamation vegetation communities at each site. Monitoring of reclamation success would be conducted according to requirements set forth by the BLM and CDRMS.

### 2.3.8. Schedule and Workforce

Alternative A includes a 100-year expected life-of-mine period if annual production rates were increased to approximately 2 to 4 million short tons of rock material. Mining activity would commence upon BLM and other required approvals. Daily operations under Alternative A would be similar to current operations with mining and processing limited to daylight periods only and 24-hour loading of material for transport by rail cars and trucks. Phase 1 would include two 10-hour shifts (one material production shift and one equipment maintenance shift) and Phases 2-5 would include three overlapping 10-hour shifts (two material production shifts and one equipment maintenance shift).

### 2.3.9. Applicant and BLM Proposed Design Features

During construction and operation of Alternative A, Martin Marietta would implement proposed design features by BLM, as well as applicant-proposed design features to avoid, reduce, and mitigate potential impacts to air, land, water, wildlife, and other resources. These design features and measures are summarized in Table 2.2.

## Table 2.2. Applicant and BLM Proposed Design Features for Alternative A

| Measure Number | Resource Potentially Affected | Voluntary Design Feature[5] (Yes/No) | Required by BLM (Yes/No) | Required by Existing Permit[5] (Yes/No) | Applicant and BLM Proposed Design Features |
|---|---|---|---|---|---|
| VIS-01[1] | Visual | Yes | No | No | Viewshed impacts will be minimized by using a technique called “mine from behind” wherein the existing topography acts as a view screen, and where mining of visible elevated areas is conducted from the side away from the viewpoint. |
| REC-01[1] | All | Yes | No | No | Reclamation activities will begin in a particular part of a pit area when mining is complete in that part of the pit area, and there is no longer a need to access it. Thus, reclamation will be occurring concurrently with mining, in order to minimize the total disturbed acreage. |
| REC-02[1] | Reclamation, Erosion Control | Yes | No | No | Overburden and topsoil would be placed in stockpiles for reuse during the reclamation process. Overburden and topsoil stockpiles that will not be used within six months of excavation will be seeded to establish a vegetative cover for stabilization and protection from erosion. |
| REC-03 | Reclamation, Topsoil Storage and Amendment | No | Yes | No | Prior to initiation of mining activity on BLM-administered lands, an assessment of the existing topsoil resources within the area of proposed disturbance would be completed by Martin Marietta to determine the adequacy of existing topsoil volumes to provide an adequate cover in areas of final reclamation. If in the event the topsoil assessment indicates existing and recoverable soil volumes are insufficient for reclamation purposes, Martin Marietta would work with the BLM and CDRMS to identify appropriate soil amendments to ensure sufficient topsoil cover for reclamation. |
| REC-04[1] | Reclamation, Erosion Control | Yes | No | No | Disturbed areas would be revegetated with the approved seed mix. Seeds will come from nursery plant stock grown on the Mineral Materials Sales Area or adjacent Martin Marietta-owned area, or would be obtained in standard containers with seed name; lot number; net weight; and percentages of purity, germination, hard seed, and maximum weed seed content clearly marked for each seed type. Seed supplies would not contain the seeds of any state recognized noxious weed species. A certificate stating that each seed lot has been tested by a laboratory with respect to the above requirements would be delivered with the seed. |
| AQ-01[1] | Air Quality | Yes | No | No | Haul roads would be watered regularly to control dust and will also be treated with a chemical dust suppressant such as calcium or magnesium chloride. |
| AQ-02[3] | Air Quality | No | No | Yes | Adequate soil moisture would be maintained in topsoil and overburden to control dust emissions during removal. Watering would be implemented if necessary. |

| Measure Number | Resource Potentially Affected | Voluntary Design Feature[5] (Yes/No) | Required by BLM (Yes/No) | Required by Existing Permit[5] (Yes/No) | Applicant and BLM Proposed Design Features |
|---|---|---|---|---|---|
| AQ-03[3] | Air Quality | No | No | Yes | Dust emissions from material handling (i.e., removal, loading, and hauling) would be controlled by watering at all times unless natural moisture is sufficient to control emissions. |
| AQ-04[3] | Air Quality | No | No | Yes | Emissions from blasting would be controlled by delay action detonators and sequential blasting practice to control emissions of Particulate Matter. |
| AQ-05[3] | Air Quality | No | No | Yes | Industry best practices would be used during all activities associated with blasting to minimize emissions of particulate matter. |
| AQ-06[3] | Air Quality | No | No | Yes | Material stockpiles would be watered as necessary to control fugitive particulate emissions. Aggregate materials would be sprayed with water during material loading into the storage bins or stockpiles. |
| WR-01[2] | Water Quality | Yes | No | Yes | Storm water and excess ground water would be captured in settling ponds on site and not discharged until they meet the limits set by a Clean Water Act NPDES permit for discharge to Tallahassee Creek. The discharge water is sampled on a monthly basis to ensure that it meets required standards of the Clean Water Act and the State of Colorado. |
| WR-02[4] | Water Quantity | No | No | Yes | Groundwater elevations would be monitored at the two monitoring wells located within the existing private property boundary for static water elevation on a semi-annual basis. Results of monitoring would be included in the annual report to CDRMS. |
| WR-03[4] | Water Quantity | No | No | Yes | Water quality monitoring would be conducted at the existing monitoring wells and springs within the BLM Sale Area. |
| WR-04[4] | Water Quality and Quantity | No | No | Yes | Monitoring would be conducted on a bi-annual basis in the same manner described under WR-02 and WR-03 at the two springs known as the Brown and Steers Springs located east of County Road 157. |
| HM-01[2] | Hazardous Materials | Yes | No | Yes | Diesel fuel for equipment is stored in a 10,000-gallon double-walled tank with an active leak detection system. The site has a spill containment plan in place and a spill containment receptacle for storage of the fuel nozzle. The tank is also surrounded by a fenced enclosure and bollards to minimize the chance that equipment could hit the tank. |

| Measure Number | Resource Potentially Affected | Voluntary Design Feature[5] (Yes/No) | Required by BLM (Yes/No) | Required by Existing Permit[5] (Yes/No) | Applicant and BLM Proposed Design Features |
|---|---|---|---|---|---|
| CS-01 | Cadastral Survey | No | Yes | No | The operator would identify and protect evidence of the PLSS and related Federal property boundaries prior to commencement of any ground-disturbing activity as directed in 43 CFR 3809.420 and CO Rev Stat §18-4-508 (2016). In the event of obliteration or disturbance of the Federal boundary marker, the operator would immediately report the incident, in writing, to the BLM Area Officer. The BLM Cadastral Survey would determine how the marker is to be restored.<br>In rehabilitating or replacing the evidence, the responsible party would reimburse the BLM for costs or, if instructed to use the services of a Certified Federal Surveyor, procurement shall be per qualification-based selection. All surveying activities would conform to the Manual of Surveying Instructions and appropriate State laws and regulations. The BLM Cadastral Survey would review local surveys before being finalized or filed in the appropriate State or county office. The responsible party would pay for all survey, investigation, penalties, and administrative costs. |

Sources: [1] Mine and Reclamation Plan (Martin Marietta 2016); [2] Resource Economics 2019; [3] CDPHE Construction Permit #00FR0687F; [4] 1997 CDRMS 112 Permit M-97-054; [5] Design features required under state and local permits are not considered voluntary.

## 2.4. ALTERNATIVE B (NO ACTION ALTERNATIVE)

Under the Alternative B (No Action Alternative), the BLM would deny Martin Marietta's mineral materials application. There would be no expansion of the existing Parkdale Quarry onto BLM-administered lands. Martin Marietta would continue to mine the granitic deposit on privately-owned lands at the existing Parkdale Quarry and conduct reclamation and closure of the mine according to their existing, authorized permits. Under Alternative B, Martin Marietta plans to upgrade existing facilities to support continued mining of the granitic deposit including expenditures of approximately $3 million for a new bridge, $4 million for rail upgrades, and $54 million for a new processing plant to be developed from 2020 to 2023. Continued mining of the granitic deposit on private land would be visible from the Highway 50 corridor and adjacent areas. At the current rate of production, the existing quarry is anticipated to remain in operation for another 15 to 30 years at current production rates.

Under the Alternative B, the existing Parkdale Quarry would continue to produce aggregate material used specifically for concrete and asphalt to address current and future market demand in the Colorado and surrounding markets, until the existing supply of aggregate material located within the currently permitted quarry area is exhausted. Martin Marietta anticipates that under Alternative B, an additional four to six non-railroad supported aggregate quarries would be required to address future demand for aggregate material in the Colorado and surrounding markets. The specific locations of these quarries are unknown but would likely be located within delivery truck proximity to current and future population centers in Colorado, where demand for aggregate materials is forecasted to increase relative to population growth in the state (Resource Economics 2019). Beyond the current proposal, the BLM is unaware of any future developments related to the existing Parkdale Quarry expansion, and detailed analysis of any other future quarry developments is considered speculative and beyond the scope of this analysis.

## 2.5. ALTERNATIVE C (ALTERNATIVE SALE AREA)

In response to stakeholder concerns regarding potential impacts under Alternative A to bighorn sheep and their habitat located within the Arkansas River Canyonlands ACEC to the west of the Sale Area, Martin Marietta provided an Alternative Materials Sale area (Alternative Sale Area) boundary to the BLM for evaluation. Figure 2.5-1, Appendix C, presents the extent of the Alternative Sale Area. The Alternative Sale Area is shifted to the east approximately one half-mile, away from the ACEC, and includes the crest of Cactus Mountain.

### 2.5.1.1. Surface Ownership and Land Disturbance

The Alternative Sale Area includes 893 acres of public lands administered by the BLM RGFO, representing a reduction of 39 percent compared to Alternative A (Figure 2.5-1, Appendix C). Approximately 633 acres of the 893 total acres would be included in the area designated for mining and reclamation (Figure 2.5-1, Appendix C). Although this area would be a reduction of

Placeholder (Figure 2.5-1)

65 acres (9 percent) from the proposed mining area under Alternative A the amount of aggregate material estimated to be recoverable by Martin Marietta is similar to Alternative A (400 million tons) due to the increased elevation of the Alternative Sale Area. This volume of aggregate material proposed for sale and extraction is consistent with the purpose and need of the Proposed Action. The remaining 260 acres would serve as a perimeter buffer of undisturbed land.

### 2.5.1.2. Mining

Similar to the proposed Sale Area under Alternative A, the Alternative Sale Area under Alternative C contains an approximate resource amount of 400 million tons of mineral material. Development of the Alternative Sale Area would occur in six sequential phases over the 100-year life-of-mine as shown in Figure 2.5-1 (Appendix C). Phase 1 would be mined from west to east; Phase 2 would be mined from north to south; Phase 3 would be mined from east to west; Phases 4 and 5 would be mined from the northwest to the southwest; and Phase 6 would be mined from the north to south. The anticipated timeframes for each of the six phases and estimated surface disturbance acreages are presented in Table 2.3

**Table 2.3. Estimated Surface Disturbance and Active Mining Periods for Alternative C Phases**

| Phase Number | Phase Name | Surface Disturbance (acres) | Mining Period[1] (years) |
|---|---|---|---|
| 1 | East Pit | 138 | 25-30 |
| 2 | North Pit | 108 | 10-12 |
| 3 | West 1 Pit | 128 | 10-15 |
| 4 | West 2 Pit | 107 | 15-20 |
| 5 | South Pit | 125 | 15-20 |
| 6 | South Extension Pit | 27 | 2-3 |
| | **Total** | **633** | **-** |

Source: Martin Marietta 2019a

[1] Based on current and future anticipated production rates

Mineral materials would be excavated in the same manner as described for the granite deposit in Section 2.6, *Existing Parkdale Quarry Operations*. Alternative C includes a 100-year expected life-of-mine period if annual production rates were increased to approximately 2,000,000 to 4,000,000 short tons of rock material from the current production rate maximum of 2,000,000 short tons annually. Therefore, mining would proceed at 1,000,000 to 2,000,000 short tons per year during Phase 1 and would increase from 2,000,000 to 4,000,000 short tons per year during phases 2 to 6.

### 2.5.1.3. Materials Processing

Materials processing would occur as described in Section 2.2, *Existing Parkdale Quarry Operations*, at processing facilities owned by Martin Marietta on private land. Product loadout onto rail cars and trucks would be the same as described for Section 2.2, *Existing Parkdale Quarry Operations.*

### 2.5.1.4. Haul and Access Roads

A new haul road of 2.9 miles would be constructed on BLM-administered lands leading from the proposed active mining areas to the existing materials processing area. The haul road under Alternative C would be approximately 1.8 miles longer that the haul road under Alternative A due to the rugged topography of the Alternative Sale Area and increased distance between the aggregate resource and processing area. The haul road would be designed to industry standards and include a running width of 60 feet to allow safe vehicle passage.

### 2.5.1.5. Ancillary and Support Facilities

Ancillary and support facilities would remain the same as described under Alternative A in Section 2.3.5, *Ancillary and Support Facilities*, at Martin Marietta's privately-owned processing area.

### 2.5.1.6. Site Security, Signs and Fencing

Implementation of site security including the installation of signage and fencing would be the same as described under the Proposed Action in Section 2.3.5.1, *Site Security, Signs, and Fencing*.

### 2.5.1.7. Growth Media Stockpiles (GMS)

Topsoil and growth media management under Alternative C would be the same as described under Alternative A in Section 2.3.6, *Growth Media Stockpiles*, and would remain consistent with the requirements under the current Parkdale Quarry CDRMS operating permit and Fremont County CUP.

### 2.5.1.8. Closure and Reclamation Plan

Reclamation and closure under Alternative C would proceed as described in Section 2.3.7, *Closure and Reclamation Plan*, for Alternative A. Appendix D contains the complete mine closure and reclamation plan that is applicable to Alternative C.

Existing topsoil depths at the Parkdale Quarry and the proposed Alternative Sale Area range from six to 60 inches across various locations (Agile Stone 1997, NRCS 2020). Field investigation of salvageable topsoil volumes for stockpiling during operations and placement as cover during final reclamation are incomplete. Under Alternative C, the BLM would require

Martin Marietta to complete an assessment of salvageable topsoil material across the five proposed mine phases and determine the potential need to identify additional soil amendment material to ensure adequate topsoil cover material (see Design Feature REC-003 in Table 2.2). Previous and ongoing reclamation activity at the Parkdale Quarry has been completed successfully by Martin Marietta through the use of existing topsoil resources for reclamation purposes.

#### 2.5.1.9. Schedule and Workforce

Mining activity would commence upon BLM and other required approvals. Daily operations under Alternative C would be similar to current operations with mining and processing limited to daylight periods only and 24-hour loading of material for transport by rail cars and trucks. Phase 1 would include two 10-hour shifts (one material production shift and one equipment maintenance shift) and Phases 2-5 would include three overlapping 10-hour shifts (two material production shifts and one equipment maintenance shift). Workforce estimates for Alternative C would include the creation of an additional 8-18 full-time staff positions located at the Parkdale Quarry.

#### 2.5.1.10. Applicant-committed Design Features

The applicant-committed environmental protection measures or design features shown in Table 2.2 would be implemented for Alternative C. These measures and design features would avoid, reduce, or mitigate potential impacts to air, land, water, wildlife, and other resources.

## 2.6. ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

Previous conceptual Sale Area and mining area boundaries have been considered by Martin Marietta in coordination with the BLM and are discussed in the following section.

### 2.6.1. Original Proposed Sale Area Boundary Alternative

#### 2.6.1.1. Avoidance of Resources of Concern

The original proposed Sale Area boundary was revised upon the completion of resource surveys that identified resources of concern in the vicinity of the proposed Sale Area boundary. The original Sale Area boundary has not been carried forward for analysis in this EIS as it would result in increased adverse impacts to resources of concern.

### 2.6.2. Reduced Life-of-Mine Alternative

During the development of this EIS, the BLM considered an alternative that included a reduction in the 100-year life-of-mine under Alternative A (Proposed Action) to a 50-year life-of-mine. This reduction would be achieved through the reduction in the approved Sale Area to approximately 750 acres resulting in an active mining area of approximately 350 acres. This reduced life-of-mine alternative was considered for analysis but not carried forward as Martin Marietta determined that the alternative would not be economically feasible to implement due to the required economic investment costs to effectively process the granitic deposit requiring an approved mineral material sale of an amount equal to that proposed under Alternative A. This alternative does not meet the purpose and need of the proposed Mineral Materials Sale.

### 2.6.3. Mining Area Avoidance of Currant Creek

During pre-application discussions between Martin Marietta and the BLM, the originally proposed mining area boundary was located in closer proximity to sections of Currant Creek. The BLM provided Martin Marietta recommendations for avoiding and minimizing potential impacts to aquatic and other resources under the original proposed mining area. In response to BLM recommendations, Martin Marietta revised the proposed mining area boundary to be located further away from Currant Creek in order to avoid potential direct and indirect impacts to resources associated with Currant Creek. The originally proposed mining area boundary is not carried forward for analysis in this EIS as it would result in increased adverse impacts to aquatic and other resources associated with Currant Creek.

### 2.6.4. Production of Aggregate Only Alternative

Martin Marietta has considered an alternative proposal that would only include production of aggregate material for road and concrete construction uses. Under this alternative, railroad ballast material would not be produced from materials extracted from the proposed Sale Area. After completion of internal economic forecasting of future demand for both construction aggregate and railroad ballast material, Martin Marietta determined that production of railroad ballast material is required to meet the purpose and need of the Proposed Action through ensuring long-term economic feasibility of the operation.

## 2.7. COMPARISON OF ALTERNATIVES

Table 2.4 presents a summary comparison of keys aspects and design criteria of the Proposed Action and alternatives carried forward for detailed evaluation.

## Table 2.4. Comparison of Proposed Action and Alternatives

| Impact | Alternative A[1] (Proposed Action) | Alternative B[2] (No Action Alternative) | Alternative C[1] (Alternate Sale Area) |
|---|---|---|---|
| Life of Mine (years) | 100 | 15-30 | 100 |
| Number of Phases | 5 | 3 | 6 |
| Phase 1 Surface Disturbance (acres) | 81 | 40 | 138 |
| Phase 2 Surface Disturbance (acres) | 166 | 40 | 108 |
| Phase 3 Surface Disturbance (acres) | 228 | 40 | 128 |
| Phase 4 Surface Disturbance (acres) | 110 | NA | 107 |
| Phase 5 Surface Disturbance (acres) | 113 | NA | 125 |
| Phase 6 Surface Disturbance (acres) | NA | NA | 27 |
| Total Surface Disturbance on BLM-administered Land (acres) | 698 | 0 | 633 |
| Length of New Haul Road (miles) | 1.1 | - | 2.9 |
| Direction of Mining | Northwest to Southeast | Varies by phase, generally south to north | Varies by phase, generally south to north |
| Aggregate Reserves (short tons) | 400,000,000 | 37,000,000-47,000,000 | 400,000,000 |
| Annual Aggregate Production (short tons) | 2,000,000-4,000,000 | 800,000-2,000,000 | 2,000,00-4,000,000 |
| Products | Concrete, asphalt, and railroad ballast | Concrete and asphalt | Concrete, asphalt, and railroad ballast |
| Number of Daily Production Shifts | 2 | 1 | 2 |
| Total Direct Employment (full time staff)[3] | 53-63 | 45 | 53-63 |
| Proximity to Arkansas River Canyonlands ACEC | Southwest border of proposed mining area borders the ACEC | Current western boundary borders the ACEC | Proposed Alternative Sale Area is located 0.4 miles to the east of the ACEC border |
| Lands with Wilderness Characteristics | 1,996 acres (6%) would be eliminated from the Echo Canyon unit | 0 acres would be eliminated from the Echo Canyon unit | 1,233 acres (%4) would be eliminated from the Echo Canyon unit |
| Air Quality | Emissions increases would be within existing thresholds. Amendment to the existing CDPHE permit would be required. | Current emissions are less than regulated thresholds. CDPHE emissions permit is in place. | Same as Alternative A |

| Impact | Alternative A[1] (Proposed Action) | Alternative B[2] (No Action Alternative) | Alternative C[1] (Alternate Sale Area) |
|---|---|---|---|
| Overall Water Use Rate | Similar use rate to Alternative B. Minimal groundwater and surface water effects. | 1,500 gpm is the current use rate | Similar use rate to Alternative B. Minimal groundwater and surface water effects. |
| Daily Water Consumption[4] | Similar use rate to Alternative B. Minimal groundwater and surface water effects. | 10 gpm | Similar use rate to Alternative B. Minimal groundwater and surface water effects. |
| Wildlife | 81-705 acres of bighorn sheep and mule deer habitat would be incrementally disturbed and then reclaimed over the life-of-mine | No habitat disturbance on BLM-administered lands | 138-633 acres of bighorn sheep and mule deer habitat would be incrementally disturbed and then reclaimed over the life-of-mine |
| Visual | Mining activity would be minimally visible from Highway 50 during the life-of mine. Processing area would remain visible from Highway 50. | All phases would remain visible from Highway 50 | Most phases would be visible from Highway 50 |

[1] Proposed surface disturbance would be located solely on BLM-administered lands.
[2] Surface disturbance would occur entirely on Martin Marietta's privately-owned lands. Approximately 120 acres of private land would be disturbed over the three phases (approximately 40 acres per phase).
[3] Includes current and future staff positions.
[4] The majority of current water use is from recycled water. Consumptive uses include the existing wash plant and haul road dust control.

## 2.8. BLM PREFERRED ALTERNATIVE

The BLM-preferred alternative for the Parkdale Quarry EIS will be identified after taking into consideration public and agency comments on this DEIS.

# CHAPTER 3. ISSUES ANALYSIS

## 3.1. INTRODUCTION

This chapter summarizes the evaluation of resource-related issues generated by the proposed Parkdale Quarry Expansion and alternatives analyzed in this EIS. It also includes a description of the past, present, and reasonably foreseeable future actions (RFFAs) that may result in cumulative impacts with the proposed project or alternatives.

Alternatives analyzed in this chapter include Alternative A (Proposed Action), Alternative B (No Action Alternative), and Alternative C (Alternative Sale Area). Alternative options considered but eliminated from detailed analysis are described in Section 2.4.3.

Baseline information summarized and presented in this chapter was obtained from published and unpublished materials; discussions with local, state, and federal agency staff; field and laboratory studies conducted in the project area; and on-site experience with mining and reclamation. The affected environment for individual resources was delineated based on the area of potential direct and indirect environmental impacts for the proposed project.

This chapter also describes the anticipated direct and indirect impacts of the proposed project and the alternatives, as well as potential cumulative impacts. The analysis of potential impacts from the proposed project assumes the implementation of regulatory requirements and the Applicant Committed Design Features presented in Section 2.3.9 that would be implemented in association with the proposed project. Potential mitigation and monitoring developed in response to anticipated impacts for individual resources are presented and analyzed by the BLM at the end of each resource section. This chapter also identifies residual impacts, which are impacts that would remain after mitigation measures have been implemented.

The proposed project may result in cumulative effects associated with other past, present, and RFFAs in the area. For resources where project-specific impacts are identified, the cumulative effects associated with the proposed project were evaluated together with other past, present, and RFFAs. The period of potential cumulative impact is defined as the approximately 100-year mine life of the project followed by 5 to 15 years of final reclamation. The cumulative effects analysis for each resource addressed the potential cumulative effects within the resource-specific cumulative effects study area (CESA). Cumulative effects, including descriptions of and rationale used to develop CESAs, are discussed on a resource-by-resource basis in Chapter 3.

### 3.1.1. General Setting

The Parkdale Quarry is located in Fremont County, Colorado, approximately 12 miles west of the Town of Cañon City, Colorado (Figure 1.1-1, Appendix C). The surrounding terrain consists of rugged pinyon-juniper dominated hillsides surrounding open grassland dominated valleys, with the proposed project site situated in the southern Rocky Mountains physiographic province.

Elevations within the proposed Sale Area boundary range from approximately 5,800 feet to 7,200 feet amsl.

### 3.1.2. Supplemental Authorities

To comply with the NEPA, and in accordance with the BLM NEPA Handbook (H-1790-1) (BLM 2008a) the BLM considered the following supplemental authorities and resources in determining what resources are present within the proposed Sale Area and could be potentially affected under the Proposed Action: Air Quality, ACECs, Cultural Resources, Environmental Justice, Farmlands (Prime or Unique), Floodplains, Forests and Rangelands, Grazing Management, Land Use Authorization, Lands with Wilderness Characteristics, Migratory Birds, Minerals, Noxious Weeds and Invasive Non-native Plant Species, Native American Religious Concerns, Paleontological Resources, Recreation Riparian/Wetlands, Social and Economic Values, Soils, Special Status Species, Vegetation, Visual Resources, Waste (Hazardous and Solid), Water Quality and Quantity, Wild and Scenic Rivers, Wilderness, Wild Horses and Burros, and Wildlife. Section 3.3, *Issues Evaluation*, presents rationale for the authorities and resources carried forward for detailed analysis.

## 3.2. CUMULATIVE EFFECTS

This section summarizes cumulative effects from past, present, and RFFAs for the Proposed Action and forms the basis for the discussion of cumulative impacts. Cumulative impacts under NEPA are defined by the CEQ as:

> “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time”
>
> (40 Code of Federal Regulations 1508.7).

Cumulative effects are discussed on a resource-by-resource basis in Chapter 3 sections, including the description of and rationale used to develop individual resource CESAs. Table 3.1 presents information regarding resource CESAs.

**Table 3.1. Cumulative Effect Study Areas by Resource**

| Resource | CESA Description | CESA Name | Size of CESA (acres) |
|---|---|---|---|
| Air Quality | Proposed Sale Area and a 31-mile radius | Air CESA | 2,588,000 |
| Water Resources | 6th-level USGS hydrologic unit code 12 sub-watersheds that contain the Sale Area or parts of the analysis area | Water CESA | 122,688 |
| Wildlife Resources | Varies by species. See Section 3.6.3 for CESA descriptions. | | |
| Lands with Wilderness Characteristics | Echo Canyon Area | LWC CESA | 31,600 |
| Visual Resources | Proposed Sale Area and a 15-mile radius | Visual CESA | 451,840 |
| Socioeconomic Resources | Fremont County | Socioeconomics CESA | 918,760 |

Relevant projects and actions are defined for the EIS as those past, present, and RFFAs that could interact with the Proposed Action or alternatives in a manner that would result in cumulative impacts, resulting primarily from mining, commercial activities, and public uses.

## 3.2.1. Past and Present Actions

Past and present development projects and other actions within Fremont County include historic and ongoing activities including mining, grazing, recreation, other commercial activities, and wildfire occurrence. Past and present projects and actions are identified for those specific actions for which impacts upon the natural environment would contribute incrementally to impacts from the Proposed Action or action alternatives and are considered in the cumulative effects analysis are described in Table 3.2.

## Table 3.2. Surface Disturbance Associated with Past and Present Actions and RFFAs within the Resource CESAs

| Action | Past and Present Disturbance (acres) | Projected RFFA Disturbance (acres) | Total Disturbance (acres) |
|---|---|---|---|
| ***Mines and Quarries (Product Type)[1]*** | | | |
| AZCO Construction/AZCO Pit (sand, gravel) | <10 | - | <10 |
| Maars Memorial (aggregate) | <10 | - | <10 |
| High Plains/South 40 Quarry (stone) | <10 | - | <10 |
| Iron Mountain (gravel) | <10 | - | <10 |
| Seifert Construction/Tallahassee Pit (sand and gravel) | <10 | - | <10 |
| Vallie Gravel (sand, gravel) | <10 | - | <10 |
| Byzantine Quarry (limestone, granite, sandstone) | 18 | - | 175 |
| Continental Materials/Canon Dolomite Quarry (dolomite) | 30 | 157 | 481 |
| Continental Materials/Grisenti Farms (sand, gravel) | 102 | 451 | 115 |
| Fremont Paving & Redi-Mix/McKenzie Pit (sand, gravel) | 2 | 13 | 33 |
| Fremont Paving & Redi-Mix/Penrose Pit (sand, gravel) | 90 | 31 | 821 |
| Fremont Paving & Redi-Mix/Florence South Pit (sand, gravel) | 14 | 731 | 23 |
| Front Range Aggregates/Parkdale (sandstone, gravel, granite) | 127 | 9 | 513 |
| Holcim/Portland Limestone Quarry (limestone) | 760 | 386 | 1600 |
| Krauth Co/J&J Stone Pit (sandstone) | 4 | 840 | 115 |
| Langston Concrete/Florence Sand & Gravel Pit (sand, gravel) | 38 | 111 | 77 |
| Pioneer Sand Company/Philips Ranch Property (sand, gravel) | 44 | 39 | 175 |
| Pioneer Sand Company/Hardscrabble Pit (sand, gravel) | 10 | 131 | 146 |
| Ranch Land LLC/Ranch Land Rock Pit (gravel) | 44 | 136 | 920 |
| Rockbottom LLC/Spotted Burro Pit (sand, gravel) | 16 | 876 | 54 |
| Rockbottom LLC/Oak Creek Gravel Pit (gravel) | 8 | 38 | 26 |
| Rocky Mountain Materials/Red Canyon (aggregate, sand, gravel) | 59 | 18 | 675 |
| Rocky Mountain Materials/Penrose Ranch's (sand, gravel) | 192 | 616 | 2496 |

| Action | Past and Present Disturbance (acres) | Projected RFFA Disturbance (acres) | Total Disturbance (acres) |
|---|---|---|---|
| Rocky Mountain Materials/Coyote Ridge (sand, gravel) | 8 | 2304 | 193 |
| Tezak Heavy Equipment/T.H.E. Aggregate Source (granite, sand, gravel) | 96 | 185 | 231 |
| Tezak Stone & Aggregate/Tezak No 2 (sand, gravel) | 20 | 135 | 20 |
| Yevoli Cobblestone Pit (sand, gravel) | 5 | 0 | 84 |
| Parkdale Quarry Exploration Activity | <5 | 0 | <5 |
| ***Utilities and Infrastructure*** | | | |
| Roads | 12,856 | - | 12,856 |
| Railroads | 3,472 | - | 3,472 |
| Communication sites | 239 | - | 239 |
| Transmission Lines | 7,645 | - | 7,645 |
| ***Other*** | | | |
| Wildfires (2002-2013) | 4,000 | - | 4,000 |
| **Totals** | **25,899** | **7,207** | **33,185** |

[1] Applies to mines and quarries only.

Recreational activities occur mainly on the Arkansas River and at the Royal Gorge Park. Multiple white-water rafting companies offer rafting tours through the area and fishing is also popular in the area. The Royal Gorge Park is open year-round and visitors come to enjoy the view from the bridge, the gondola ride, and the zip line, among other activities. The Arkansas River is designated as a Gold Medal fishery upstream of, and in the area adjacent to the existing Parkdale Quarry.

## 3.2.2. Reasonably Foreseeable Future Actions

RFFAs for the Parkdale Quarry Expansion EIS cumulative effects analysis include other projects or actions that potentially impact those resources that would be impacted by the Proposed Action during the same period of time (including final reclamation). RFFAs for which disturbance acreages can be quantified are presented in Table 3.2 and RFFAs for which disturbance acreages are unknown are described below. RFFAs identified in this section must also have been determined by the BLM as having a reasonable likelihood of moving forward towards development and to be located within the boundaries of the various CESAs for the Proposed Action.

The Fremont County Master Plan predicts a moderate population growth trend and the future sprawl of mixed development along the Arkansas Valley and scattered residential settlement farther west that would threaten to undermine the scenic, rural qualities of those mountain and plains areas that are necessary to attract quality growth (Fremont County Planning

Commission 2015). Future residential growth would also result in additional requests for rights-of-way associated with new roads and other community infrastructure. Additionally, increased motorized and non-motorized recreational use of BLM lands, particularly along the Arkansas River, is anticipated.

Mining in Fremont County typically provides construction materials for out-of-county development along the Colorado Front Range. Due to the relatively high predicted population increase along the Front Range (36 percent between 2018 and 2040 [Colorado Department of Local Affairs 2017]), demand for aggregates is expected to continue at the same or greater rate. Future demand for both freight and passenger rail service in Colorado and adjacent states is projected to increase in the coming decades due to population growth statewide (CDOT 2018). This increase in demand is likely to result in an increased demand for rail ballast material for maintenance and construction of rail lines.

Other development predicted in the Draft Eastern Colorado Resource Management Plan that could contribute to cumulative impacts includes renewable energy facilities, utility and road rights of way, vegetation treatments and hazardous fuels reduction, spread and invasion of noxious weeds, continued changes and possible intensification to Colorado’s climate in association with global climate change, and increasing wildfire occurrence and intensity.

## 3.3. ISSUES EVALUATION

The CEQ regulations state that NEPA documents “must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail” (40 CFR 1500.1[b]). Although many issues may arise during scoping, not all of them warrant analysis in an EIS. An issue is analyzed if (1) an analysis is necessary to make a reasoned choice between alternatives, or (2) the issue is associated with significant direct, indirect, or cumulative effects, or analysis is necessary to determine the significance of the effects. Minor issues not requiring detailed analysis are those where the effects are negligible or are mitigated through the design features of the alternatives. Table 3.3 summarizes issues identified by resource that are carried forward for detailed analysis in this EIS. Table 3.4 presents resources for which no issues were identified or for which issues were identified but not carried forward for detailed analysis.

## Table 3.3. Issues Carried Forward for Evaluation by Resource Area or Supplemental Authority

| Program Area | Issue Statement | Resource Present? (Yes/No) | Brought Forward for Analysis? (Yes/No) | Rationale | Addressed in Section |
|---|---|---|---|---|---|
| Air Resources and Climate | 1) What types and amounts of hazardous air pollutants would be released as a result of the proposed Parkdale Quarry expansion, and what are the potential health and environmental effects?<br>2) What types and amounts of criteria air pollutants would be emitted as a result of the proposed Parkdale Quarry expansion, and what are the potential effects to ambient air quality in the region?<br>3) What types and amounts of greenhouse gases that would contribute to global climate change would be emitted as a result of the proposed Parkdale Quarry expansion? | Yes | Yes | Parkdale Quarry expansion effects on air quality were identified as a key issue during scoping. | 3.4 |
| Social and Economic Conditions | How would the proposed Parkdale Quarry expansion affect social and economic conditions in Fremont County, including tourism? | Yes | Yes | Parkdale Quarry expansion effects on social and economic conditions in Fremont County were identified as a key issue during scoping. | 3.9 |
| Visual Resources | What is the extent of impact on sensitive visual receptors resulting from the change in landforms during operations and post-mining? | Yes | Yes | Public scoping identified potential visual impacts as a key issue. | 3.8 |
| Water Quality, Surface and Ground | 1) What are the water sources and water requirements for the Parkdale Quarry expansion?<br>2) Is dewatering anticipated to be required in any of the pits?<br>3) How would the proposed Parkdale Quarry expansion affect water quality, quantity, and water rights?<br>4) How would surface water and groundwater be monitored for the proposed mine expansion? | Yes | Yes | Parkdale Quarry expansion effects on water resources in the study area were identified as a key issue during scoping. | 3.5 |
| Lands with Wilderness Characteristics | How would the proposed Parkdale Quarry Expansion affect the currently inventoried area identified as having wilderness characteristics? | Yes | Yes | The proposed mine expansion area contains lands determined through inventory to possess wilderness characteristics, but these lands are not specifically managed to protect or maintain wilderness characteristics under the Royal Gorge Resource Area | 3.7 |

| Program Area | Issue Statement | Resource Present? (Yes/No) | Brought Forward for Analysis? (Yes/No) | Rationale | Addressed in Section |
|---|---|---|---|---|---|
| | | | | RMP. Lands within the proposed mine expansion area would no longer qualify as lands with wilderness characteristics once mining activities commence. | |
| Wildlife: Migratory Birds | How would the proposed Parkdale Quarry expansion affect the availability and quality of habitat and nesting sites for migratory bird species? | Yes | Yes | No raptor nests were identified within the proposed Sale Area during surveys. Migratory birds do utilize the area and the Proposed Action would affect available habitat. | 3.6 |
| Wildlife: T&E, Sensitive Species | How would the proposed Parkdale Quarry expansion affect the availability and quality of habitat for special status wildlife species? | Yes | Yes | The proposed Sale Area does provide habitat for some BLM sensitive species and the Proposed Action would affect available habitat. No habitat for federal T&E species is located within the proposed Sale Area. | 3.6 |
| Wildlife: Terrestrial | How would the proposed Parkdale Quarry expansion affect the availability and quality of habitat for bighorn sheep and other big game species? | Yes | Yes | The Proposed Action would remove suitable habitat for big game species. | 3.6 |

NA = Not Applicable

## Table 3.4. Resource Area or Supplemental Authority for Which No Issues Were Identified or Not Carried Forward for Detailed Evaluation

| Program Area | Issue Statement | Resource Present? (Yes/No) | Brought Forward for Analysis? (Yes/No) | Rationale |
|---|---|---|---|---|
| Cadastral Survey | No issues identified. | Yes | No | Due to resurveys in the subject area, the location of the Public Land Survey System (PLSS) bounding the Mineral Material Sale project is known to a high degree of certainty (10 feet) and therefore, the proposed buffer is considered adequate. There are 12 PLSS monuments that would be identified and protected prior to ground disturbing activities as directed in 43 CFR 3809.420 and CO Rev Stat §18-4-508. |
| Cultural Resources | Will the undertaking directly, indirectly, or cumulatively, and adversely, affect any historic properties present in the area of potential effects? | No | No | A historic property (a site eligible for the National Register of Historic Places [NRHP]) was found in the area of potential effects (see report CR-RG-17-101 P). However, the historic property will not be affected by the proposed undertaking, as project redesign eliminated the site from the area of potential effects. |
| Environmental Justice | Will the proposed Parkdale Quarry expansion disproportionally impact environmental justice populations? | No | No | Review of 2017 U.S. Census data indicates that Fremont County does not have environmental justice populations (Table 3.15) that meet the criteria of having five percentage points greater than the State of Colorado. |
| Farmlands, Prime and Unique | No issues identified. | No | No | The U.S. Department of Agriculture, Natural Resources Conservation Service soil survey for Fremont County Area, Colorado classifies several soil map units as “prime farmland if irrigated” along Tallahassee Creek, County Road 157, and U.S. Highway 50. These soils are confined to floodplains along Tallahassee Creek and the Arkansas River and do not extend into the proposed mine expansion area, which is predominantly confined to adjacent upland areas. No direct or indirect effects to these soils are anticipated from the Parkdale Quarry expansion, and there is no current or anticipated use of these lands for agriculture. |
| Wildland Fire and Fuel Management | No issues identified. | No | No | The BLM would continue to manage wildland fire and fuels on BLM-administered lands outside of the mineral material Sale Area in accordance with current policies and practices. Martin Marietta would implement best practices for wildfire prevention and response, minimizing the potential for mining activities to ignite a wildfire within or adjacent to the proposed mine expansion area. |

| Program Area | Issue Statement | Resource Present? (Yes/No) | Brought Forward for Analysis? (Yes/No) | Rationale |
|---|---|---|---|---|
| | | | | The BLM would require a contract to purchase forest products to be in place prior to new disturbances. Forest product removal would reduce fuel loading and risk of wildland fire. All forest products and other vegetative material would be harvested, stored, and removed or disposed of in accordance with BLM specifications, and in a manner that minimizes the potential for wildfire ignition. |
| Forest Management | No issues identified. | Yes | No | The BLM would require a contract to purchase forest products to be in place prior to new disturbances. All forest products and other vegetative material would be harvested, stored, and removed or disposed of in accordance with BLM specifications, and in a manner that minimizes the potential for wildfire ignition. |
| Geology and Minerals | No issues identified. | Yes | No | There are no known coal resources within the vicinity of the proposed mine expansion area. Various metals and nonmetallic minerals have the potential to occur in areas of Fremont County in proximity to the Parkdale Quarry; however, all active mining claims within the proposed mine expansion area are held by Martin Marietta. There is no potential for oil and gas development or active leases in the vicinity of the proposed mine expansion boundary. |
| Invasive Plants | How would the proposed Parkdale Quarry expansion affect the potential for invasive plants to colonize and spread during and after the operational life of the mine? | Yes | No | Noxious weeds and non-native plant species infestations are limited to areas of historic disturbance associated with past livestock grazing along Currant Creek within the proposed buffer area. Martin Marietta design features would address treatment of weeds under the Proposed Action. |
| Lands and Realty | No issues identified. | Yes | No | The proposed Parkdale Quarry expansion would not alter existing land ownership and administration. |
| Noise | How would noise impact recreation activity within the Arkansas Headwaters Recreation Area? | Yes | No | Recreation activity is currently affected by existing mining and processing operations. The proposed action and alternatives would not substantially alter the level of noise resulting from mining and processing activity and therefore user experience within the AHRA would be similar to Alternative B. |

| Program Area | Issue Statement | Resource Present? (Yes/No) | Brought Forward for Analysis? (Yes/No) | Rationale |
|---|---|---|---|---|
| Paleontology | No issues identified. | No | No | The BLM conducted a paleontological survey for the exploration work that was conducted within the proposed mine expansion area during preparation of the Parkdale Area Mineral Materials Sampling EA. The only area with potential fossil yield was located in the vicinity of the sandstone outcrop on the southern edge of the proposed mine expansion area. The proposed mine expansion area was modified to exclude this area and therefore would eliminate the potential for direct effects to the paleontological resources. |
| Range Management | No issues identified. | Yes | No | The proposed mine expansion area overlaps the Parkdale grazing allotment, which is permitted to Stone & Long for 128 authorized AUMs. The proposed mining area occurs in an area that is currently not accessible to livestock due to steep rocky slopes and limited forage production. Therefore, the proposed mine expansion area does not account for any loss of allocated AUMs. |
| Recreation | How would public access for recreational activities and recreational opportunities and settings on lands within and surrounding the proposed mine expansion area be affected? | Yes | No | Public access to the area is difficult but if a recreationist gained access to the area, the recreational opportunities and settings would be changed from its current state with the proposed expansion. The mine expansion would increase the amount of noise, light with night activity, and increased human activity in the area. This might deter recreationists seeking solitude and quiet. Considering mining activity is already occurring in the area, the change would be expected to be minor. The Proposed Action is not anticipated to impact the ability for the public to access the Arkansas Headwaters Recreation Area or substantially change the visitors experience. Impacts to the Arkansas Headwaters Recreation Area would be similar in nature to those currently experienced due to current mining at Parkdale. |
| Soils | No issues identified. | Yes | No | Martin Marietta proposes to separate, store, and reclaim topsoil in accordance with best management practices and procedures specified in the mining and reclamation plan. Implementation of these practices and procedures would minimize soil losses as a result of the quarry expansion. |
| Tribal Concerns | Will the undertaking affect historic properties with traditional and religious significance to tribes? | Yes | No | The BLM consulted with 16 tribes regarding this undertaking (Apache Tribe of Oklahoma, Cheyenne and Arapaho Tribes of Oklahoma, Cheyenne River Sioux Tribe, Comanche Nation of |

| Program Area | Issue Statement | Resource Present? (Yes/No) | Brought Forward for Analysis? (Yes/No) | Rationale |
|---|---|---|---|---|
| | | | | Oklahoma, Crow Creek Sioux, Eastern Shoshone, Jicarilla Apache Nation, Kiowa Tribe of Oklahoma, Northern Arapaho Tribe, Northern Cheyenne Tribe, Northern Ute Tribe, Oglala Sioux Tribe, Rosebud Sioux Tribe, Southern Ute Tribe, Standing Rock Lakota Tribe, and the Ute Mountain Ute Tribe). Several tribes requested additional consultation, including the opportunity to visit the area of potential effects. The tribes that requested additional consultation were extremely concerned about the highly sensitive site that had been eliminated from the area of potential effects. They requested that the area in which the site is located never be developed or added back into the project. The operator assured them that it would not ever be included in the area of potential effects. |
| Vegetation | How would the proposed Parkdale Quarry expansion affect the abundance and composition of plant communities during operations and post-mining? | Yes | No | No unique vegetation communities were documented within the proposed Sale Area during surveys. Existing vegetation would be removed from the site and reclaimed upon mining completion. |
| Wastes, Hazardous or Solid | No issues identified. | N/A | No | Hazardous or solid wastes would be managed in accordance all applicable laws and regulations. Martin Marietta anticipates limited to no use of hazardous wastes at the mine. |
| Wetlands and Riparian | Would the proposed Parkdale Quarry expansion affect any waters of the United States, as determined by the U.S. Army Corps of Engineers? | Yes | No | No wetland areas determined to be jurisdictional waters of the United States have been identified within the proposed materials mining area. Some limited areas of riparian vegetation associated with isolated spring locations would be removed under the Proposed Action. |
| Wildlife: Aquatic | No issues identified. | No | No | No aquatic wildlife resources have been identified within the proposed mine expansion area and no indirect effects are anticipated to aquatic wildlife resources downstream of the mine pending the results of the water resources analysis prepared for the EIS. |
| Special Designations – Areas of Critical Environmental | No issues identified. | Yes | No | The proposed mine expansion area was modified to avoid the Arkansas Canyonlands ACEC, such that there would be no effect to the Arkansas Canyonlands ACEC resulting from the proposed expansion of the Parkdale Quarry. |

| Program Area | Issue Statement | Resource Present? (Yes/No) | Brought Forward for Analysis? (Yes/No) | Rationale |
|---|---|---|---|---|
| Concern | | | | |
| Special Designations – Wild and Scenic Rivers | No issues identified. | Yes | No | The BLM assigned a tentative classification as suitable (recreational) for inclusion in the Wild and Scenic River System to the segment of the Arkansas River that flows from Salida to Parkdale and passes directly south of the Parkdale Quarry, known as Arkansas River Segment 3. The ORVs for this segment are recreation, scenery, wildlife, botany, fish and cultural The proposed project would not impact recreation, wildlife, botany, fish, and cultural ORVs because those ORVs are confined to the footprint of the suitable stream segment, which is limited to ¼ mile on each side of the river from the ordinary high-water mark. The scenery ORV would not be impacted because visitors using the river would not be able to see the mining activities from the river, and because overall, the project is designed to minimize visual impacts. |
| Special Designations – Wilderness, Wilderness Study Areas, or Natural Areas | How would the proposed Parkdale Quarry Expansion affect the proposed Table Mountain Wilderness Area? | No | No | The nearest existing wilderness or wilderness study area or Natural Area is the High Mesa Grassland Natural Area, is located more than 2.5 miles from the proposed mine expansion area. The proposed Parkdale Quarry expansion would not directly affect wilderness or wilderness study areas. The proposed Sale Area includes a limited portion of the proposed but not currently designated Table Mountain Wilderness Area. |

# 3.4. AIR RESOURCES AND GREENHOUSE GASES

**Issue 1: What types and amounts of criteria air pollutants would be emitted as a result of the proposed Parkdale Quarry expansion, and what are the potential effects to ambient air quality in the region?**

**Issue 2: What types and amounts of hazardous air pollutants would be released as a result of the proposed Parkdale Quarry expansion, and what are the potential health and environmental effects?**

**Issue 3: What types and amounts of greenhouse gases that would contribute to global climate change would be emitted as a result of the proposed Parkdale Quarry expansion?**

## 3.4.1. Affected Environment

Air pollution and greenhouse gases (GHGs) within the planning area originate from such sources as industry, agricultural activities, energy production, transportation, residential activities, and consumer product use. The U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for criteria pollutants, which include carbon monoxide (CO), nitrogen dioxide ($NO_2$), ozone, particulate matter ($PM_{10}$ and $PM_{2.5}$), sulfur dioxide ($SO_2$), and lead. The State of Colorado also has its own ambient air quality standards that are similar to the NAAQS. EPA designates areas as attainment (having pollutant levels that are within the NAAQS), nonattainment (having pollutant levels that exceed the NAAQS), or maintenance (having pollutant levels that formerly exceeded the NAAQS but that have been reduced to attainment levels). EPA has designated Fremont County as attainment for all criteria pollutants.

Hazardous air pollutants (HAPs) are pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects. Health concerns due to hazardous air pollutants generally are considered too localized to be included under the scope of NAAQS. EPA regulates HAPs through emission standards, including National Emission Standards for Hazardous Air Pollutants, which limit emission rates and apply to affected sources that are, or are located at, major sources of HAP emissions. A major source is defined in 40 CFR 63.2 as any stationary source that emits or has the potential to emit 10 tons per year or more of any single HAP or 25 tons per year or more of any combination of HAPs. Based on the provisions of its Colorado Department of Public Health and Environment (CDPHE) air quality permit, the Parkdale Quarry is not a major HAP source.

The CDPHE measures air quality at sites throughout the state. The nearest CDPHE monitoring site to the project is located in Cañon City and measures $PM_{10}$ (EPA site ID 08-043-0003). The NAAQS for $PM_{10}$ is 150 micrograms per cubic meter ($\mu g/m^3$) averaged over 24 hours. In the most recent three years with complete data available (2016-2018), maximum 24-hour $PM_{10}$

concentrations measured at this site were 54 µg/m$^3$, 48 µg/m$^3$, and 39 µg/m$^3$, respectively, which at this site did not exceed the NAAQS.

The CDPHE assigns all geographical regions a priority class depending on how much air quality is allowed to degrade under the Prevention of Significant Deterioration (PSD) permitting rules. Class I areas are those of special national or regional natural, scenic, recreational, or historic value, and this category allows for very little degradation in air quality. Class II areas allow for reasonable industrial/economic expansion. Major stationary sources of air pollution authorized on BLM-administered lands can contribute to the consumption of PSD increments. The Parkdale Quarry is limited under its CDPHE air quality permit to emissions levels that are less than the EPA thresholds for PSD review. Therefore, the PSD requirements do not apply to Parkdale Quarry.

Visibility impairment or haze is caused when sunlight encounters tiny pollution particles in the atmosphere and is either absorbed or scattered, which reduces the clarity and color of what can be seen. Federal land management agencies including the BLM express visibility in terms of deciviews (dv). A change of one dv is approximately a 10-percent change in the light extinction coefficient (i.e., light that is scattered or absorbed and does not reach the observer), which is a small but usually perceptible scenic change. To assess the visibility impact of a project, the agencies use a threshold of 0.5 dv for projects that could contribute to a visibility problem and 1.0 dv for projects that by themselves could cause visibility issues. Measurements from the visibility monitors nearest the planning area (located at Rocky Mountain National Park and Great Sand Dunes National Park) show that existing visibility is less than under natural conditions, but shows an improving trend over time.

Deposition of air pollutants such as sulfur and nitrogen may cause acidification of soils and surface waters, affecting water chemistry, aquatic vegetation, invertebrate communities, amphibians, fish, soil microorganisms, and plants. Federal land management agencies use a threshold of 0.005 kilograms per hectare per year to assess deposition impacts of a project. The deposition monitors nearest the planning area are located at Rocky Mountain National Park and Great Sand Dunes National Park. Measurements at Rocky Mountain National Park show that existing deposition rates are greater than under natural conditions, but show a slightly improving trend over time. Measurements at Great Sand Dunes National Park show no clear trend in deposition rates.

Greenhouse gases (GHGs) are so named because of their heat-trapping capacity and contribution to global warming. These gases include carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), and several fluorinated species of gases such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. $CO_2$ is emitted from the combustion of fossil fuels (oil, natural gas, and coal), solid waste, trees, and wood products, and as a result of other chemical reactions (e.g., cement manufacturing). The production, transport, and combustion of coal, natural gas, and oil emit methane. Methane also results from livestock and other agricultural practices and from the decay of organic waste in municipal solid waste landfills. Agricultural and industrial activities as well the combustion of fossil fuels and solid waste emit $N_2O$. Fluorinated gases are powerful greenhouse gases that are emitted from a variety of industrial processes and are often used as substitutes for ozone-depleting substances (e.g., chlorofluorocarbons, hydrochlorofluorocarbons, and halons). GHG emissions commonly are expressed as $CO_2$ equivalent ($CO_2e$) which is an average of the individual gas emissions weighted according to their respective global warming potentials.

The Intergovernmental Panel on Climate Change (IPCC 2013) indicates that an increase in atmospheric GHG concentration results in an increase in the earth's average surface temperature, primarily by trapping and thus decreasing the amount of heat energy radiated by the Earth back into space. The phenomenon is commonly referred to as global warming. The Intergovernmental Panel on Climate Change expects global warming to affect weather patterns, average sea level, ocean acidification, chemical reaction rates, and precipitation rates, all of which is collectively referred to as climate change.

## 3.4.2. Environmental Effects

### 3.4.2.1. Direct and Indirect Effects from Alternative A

**Issue 1: What types and amounts of criteria air pollutants would be emitted as a result of the proposed Parkdale Quarry expansion, and what are the potential effects to ambient air quality in the region?**

An emissions inventory was developed to characterize the emissions from the Parkdale Quarry and the proposed expansion. Information on emissions from stationary sources was taken from the facility's air quality permit. Emissions from mobile sources (construction, excavation, and materials handling equipment; trucks; worker vehicles; and locomotives) were calculated based on emission factors taken from EPA models and databases, and the proposed activity levels for these sources.

Assumptions for the analysis were selected to be conservative (tending to overestimate emissions). For example, where projections indicated a range of values, the high end of the range was selected for the emissions estimate. Alternative A would increase the quarry's production rate and with it the activity levels of equipment and vehicles, which would lead to increased emissions. On the other hand, mobile source emissions on a per-unit basis are expected to decrease over time because of increasingly stringent regulation by the EPA, as older, higher-emitting trucks and equipment are retired and replaced by newer, lower-emitting ones. Because of these two opposing trends, the scenario of maximum emissions can occur in years other than those in which maximum production occurs. Accordingly, emissions were evaluated for Phase 1 in 2020 with a production rate of 2,000,000 tons per year, and for Phase 2 in 2033 with a production rate of 4,000,000 tons per year. Emissions in Phases 3 through 5 would occur after

2033 and are expected to be less than in Phase 2 for the same production level. Table 3.5 presents the estimated emissions inventory.

**Table 3.5. Estimated Emissions Inventory**

| Alternative and Source Type (Year) | Emissions (criteria pollutants in U.S. tons per year, GHGs in metric tons per year of $CO_2$ equivalent) | | | | | | |
|---|---|---|---|---|---|---|---|
| | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | VOC | GHGs |
| ***Alternative B (2020)*** | | | | | | | |
| Stationary Permitted[1] | 3 | 18 | 50 | 7 | 1 | 1 | 715 |
| Mobile (except rail)[2] | 15 | 19 | 17 | 5 | 0 | 1 | 1,498 |
| Rail | 32 | 120 | 3 | 3 | NA | 5 | 11,277 |
| Blasting[2] | 26 | 7 | 1 | 0 | 1 | NA | 201 |
| Purchased Electricity (offsite power plants) | NA[3] | 3 | NA | NA | 2 | NA | 3,829 |
| **Total** | **76** | **167** | **70** | **15** | **4** | **7** | **17,520** |
| ***Alternative A – Phase 1 (2020)*** | | | | | | | |
| Stationary Permitted[1] | 3 | 18 | 50 | 7 | 1 | 1 | 715 |
| Mobile (except rail)[2] | 17 | 22 | 17 | 5 | 0 | 1 | 1,498 |
| Rail | 84 | 314 | 7 | 7 | NA | 12 | 29,492 |
| Blasting[2] | 52 | 13 | 1 | 0 | 2 | NA | 402 |
| Purchased Electricity (offsite power plants) | NA | 8 | NA | NA | 5 | NA | 9,300 |
| **Total** | **157** | **374** | **75** | **20** | **7** | **15** | **41,407** |
| ***Alternative B (2033)*** | | | | | | | |
| Stationary Permitted[1] | 3 | 18 | 50 | 7 | 1 | 1 | 715 |
| Mobile (except rail)[2] | 39 | 39 | 17 | 18 | 0 | 2 | 1,484 |
| Rail | 14 | 16 | 16 | 4 | 0 | 1 | 11,277 |
| Blasting[2] | 26 | 7 | 1 | 0 | 1 | NA | 201 |
| Purchased Electricity (offsite power plants) | NA | 3 | NA | NA | 2 | NA | 3,829 |
| **Total** | **76** | **96** | **67** | **12** | **4** | **4** | **17,506** |
| ***Alternative A – Phase 2 (2033)*** | | | | | | | |
| Stationary Permitted[1] | 6 | 32 | 88 | 13 | 2 | 2 | 1,430 |
| Mobile (except rail)[2] | 25 | 28 | 28 | 12 | 0 | 2 | 2,520 |
| Rail | 169 | 273 | 5 | 5 | NA | 10 | 58,985 |
| Blasting[2] | 105 | 27 | 3 | 0 | 3 | NA | 804 |
| Purchased Electricity (offsite power plants) | NA | 8 | NA | NA | 5 | NA | 9,300 |
| **Total** | **316** | **378** | **125** | **26** | **10** | **16** | **73,038** |

| Alternative and Source Type (Year) | Emissions (criteria pollutants in U.S. tons per year, GHGs in metric tons per year of $CO_2$ equivalent) | | | | | | |
|---|---|---|---|---|---|---|---|
| | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | VOC | GHGs |
| ***Emissions Change with Alternative A Compared to Alternative B*** | | | | | | | |
| Phase 1 (2020) | 81 | 208 | 5 | 5 | 4 | 8 | 23,887 |
| Phase 2 (2033) | 240 | 282 | 58 | 14 | 6 | 12 | 55,532 |

Source: Martin Marietta 2019b

Emissions have been rounded to the nearest ton.
Values less than 0.5 have been rounded to zero.
Sum of individual values may not equal total due to rounding.

[1] Includes point sources and fugitive emissions. Emissions for 2020 are permitted limits.
[2] Includes combustion and fugitive emissions.
[3] NA = Not available

Emissions from stationary sources are limited by the terms of the quarry’s air quality permit to correspond to a production limit of 2,250,000 tons per year and were assumed not to change for Phase 1. However, if production rates with Alternative A were to increase above these limits, as in Phase 2, Martin Marietta would be required to apply to CDPHE for an amendment to its permit to allow the increased production and emissions. In Table 3.5**,** emissions from stationary permitted sources under Phase 2 are assumed to reflect an amended permit and have been scaled up according to production rates.

Martin Marietta plans to transition from the use of conventional diesel fuel in Phase 1 to 50 percent diesel and 50 percent electric or alternative fuels in Phase 2, and to 100 percent electric or alternative fuels in Phases 3 through 5. As a result, emissions of exhaust pollutants (primarily from mobile sources) in Phase 2 are expected to be less than shown in Table 3.5, and would be still less in Phases 3 through 5. The future emissions from power plants that would generate the electricity to charge electrified equipment and vehicles are not known because commercialization of electric technology for the applicable equipment has barely begun, and electric technology is not yet feasible for the heavier equipment. The future emission rates from alternatively-fueled equipment would depend on the selection of alternative fuels. Therefore, emission reductions that could occur from the transition to electric and alternative fuels were not quantified. This contributes to the conservatism of the analysis.

Railroad ballast would be a primary product of the Parkdale Quarry. Currently, ballast used in Colorado must be shipped by rail from quarries in Oklahoma and Wyoming. Martin Marietta projects that the Parkdale Quarry would provide a local source of ballast, which would displace ballast shipments from the larger multi-state region. As a result, under Alternative A, rail traffic and the associated emissions would increase at the Parkdale site but would decrease regionally as longer rail trips are displaced by shorter rail trips. Moreover, Martin Marietta projects that local demand for ballast under Alternative B would result in development of four additional quarries in Colorado that would ship their production by truck. Under Alternative A, the Parkdale Quarry would meet the regional demand for ballast, and to the extent that it would do so with rail shipment, truck volumes from other quarries would be decreased. This displacement of truck trips by rail would lead to additional emissions reductions. Information is not available to quantify regional emissions reductions and they are not included in Table 3.5. However, such reductions are expected to reduce the potential regional impacts of Alternative A on air quality, visibility, and acid deposition.

Based on the estimated emissions and the distances from the project to areas of likely exposure of the public to the emissions (approximately 3,000 feet or more), criteria pollutant concentrations under Alternative A are not expected to exceed the NAAQS. Alternative A is not expected to result in substantial effects on visibility or acidic deposition in Class I areas.

### *General Conformity Evaluation*

States and local authorities have the responsibility for bringing their regions into compliance with the NAAQS. State Implementation Plans are EPA-approved plans that set forth the applicable air pollution control requirements for each State. Section 176(c) of the Clean Air Act prohibits Federal entities from taking actions in nonattainment or maintenance areas that do not "conform" to the State Implementation Plan. The purpose of this conformity requirement is to ensure that Federal activities: (1) do not interfere with the emissions budgets in the State Implementation Plans; (2) do not cause or contribute to new violations of the NAAQS; and (3) do not impede the ability to attain or maintain the NAAQS. To implement Clean Air Act section 176(c), EPA issued the General Conformity Rule (40 Code of Federal Regulations 93, subpart B).

The General Conformity Rule established emissions thresholds (40 Code of Federal Regulations 93.153) for use in evaluating the conformity of a project. To evaluate conformity, all changes in direct and indirect emissions (as defined in the rule) are summed. If the net emissions increases due to the project are less than the thresholds, the project is presumed to conform and no further conformity evaluation is required. If the emission increases exceed any of the thresholds, a conformity determination is required. The BLM, as the Federal entity with jurisdiction for the proposed action, must demonstrate that the proposed action meets the requirements of the General Conformity Rule.

The Conformity Rule applies only to those pollutants for which the project area is designated nonattainment or maintenance. The Parkdale Quarry is not located within a nonattainment or maintenance area, so the General Conformity Rule does not apply to emissions at the Parkdale Quarry site. However, trucks and trains associated with the quarry travel through two maintenance areas: the Cañon City $PM_{10}$ maintenance area and the Colorado Springs CO maintenance area. Therefore, the changes in $PM_{10}$ and CO emissions, respectively, associated with Alternative A that would occur in these maintenance areas were compared to the General Conformity thresholds, which are 100 tons per year of each pollutant. Emissions were calculated for the portion of truck and train travel associated with Alternative A that would occur within the Cañon City $PM_{10}$ maintenance area and the Colorado Springs CO maintenance area. In both areas, the emissions increases that would occur under Alternative A would be less than the conformity thresholds. Accordingly, a General Conformity determination is not required for Alternative A.

### *Protective/Mitigation Measures*

Because criteria pollutant concentrations under Alternative A are not expected to exceed the NAAQS, and regional emissions reductions are expected, no protective/mitigation measures for criteria pollutants are proposed.

## Issue 2: What types and amounts of hazardous air pollutants would be emitted as a result of the proposed Parkdale Quarry expansion, and what are the potential effects to ambient air quality in the region?

Based on the provisions of its CDPHE air quality permit, the Parkdale Quarry is not a major HAP source and the project would not cause the Parkdale Quarry to become a major HAP source. Based on the Parkdale Quarry's non-major source status and the distances from the project to areas of likely public exposure (approximately 3,000 feet or more), no adverse health effects are expected from HAP emissions associated with the project.

### *Protective/Mitigation Measures*

The provisions of the Parkdale Quarry's air quality permit that limit criteria pollutant emissions also serve to limit HAP emissions. Because no adverse health effects are expected from HAP emissions associated with the project, no protective/mitigation measures for HAPs are proposed.

## Issue 3: What types of greenhouse gases would be emitted as a result of the proposed Parkdale Quarry expansion?

The primary source of GHG emissions at the Parkdale Quarry is exhaust from equipment and vehicles, and to a lesser extent from permitted stationary sources. These GHG emissions consist mostly of $CO_2$, and smaller amounts of $CH_4$ and $N_2O$. There are no NAAQS for GHGs. Potential climate impacts of Alternative A are evaluated based on GHG emissions levels. As shown in Table 3.5, GHG emissions would increase under Alternative A. These increases would contribute incrementally to current climate change trends. However, the planned transition to electric and alternatively-fueled equipment is likely to reduce GHG emissions. Also, regional GHG emissions would decrease due to displacement of longer rail trips by shorter rail trips, and displacement of trucks by rail, as discussed above for Issue #1.

### *Protective/Mitigation Measures*

The planned decrease in diesel fuel usage at the Parkdale Quarry over time is likely to decrease GHG emissions at the site. Also, Alternative A would decrease emissions regionally as discussed above for Issue #1.

### 3.4.2.2. Direct and Indirect Effects from Alternative B

Under Alternative B, the proposed expansion would not occur and there would be no impact from the project. Emissions from stationary sources at the Parkdale Quarry would continue to be limited by the provisions of its existing air quality permit. Emissions from construction equipment, trucks, and trains associated with the Parkdale Quarry would be expected to decrease slowly over time as older, higher-emitting equipment, vehicles, and locomotives are retired and replaced with newer, lower-emitting ones.

### 3.4.2.3. Direct and Indirect Effects from Alternative C

The emissions inventory under Alternative C would be similar to the emissions summarized in Table 3.2 for Alternative A. Stationary source emissions would be the same as identified in Table 3.2. Alternative C would have minor differences in on-site mobile source emissions compared to Alternative A due to slight differences in haul road routes and travel distances to the processing area on private land. Criteria pollutant concentrations under Alternative C are not expected to exceed the NAAQS based on the estimated emissions and the distances from the alternate Sale Area to areas of likely public exposure (approximately 3,000 feet or more). Alternative C is not expected to result in substantial effects on visibility or acidic deposition in Class I areas.

A General Conformity determination is not required for Alternative C because the emissions increases that would occur under Alternative C would be similar to Alternative A and therefore, less than the conformity thresholds.

Parkdale Quarry is not a major HAP source based on the CDPHE air quality permit, and the proposed expansion would not become a major HAP source. No adverse health effects are anticipated from HAP emissions associated with Alternative C.

Greenhouse gas emissions would increase under Alternative C at similar levels to Alternative A, and contribute to climate change. Reduction in greenhouse gas emissions would occur with the planned transition to electric and alternatively-fueled equipment in the future. In addition, greenhouse gas emissions would be reduced with displacement of trucks by rail transport and displacement of longer rail trips by shorter rail trips as a result of Alternative C.

## 3.4.3. Cumulative Effects Analysis

The CESA for air resources is defined as the proposed Sale Area and a 50-kilometer (31-mile) radius around the project. Past, present, and reasonably foreseeable future actions that could contribute to cumulative impacts to air quality include an increase in industrial, commercial, and residential development and motorized vehicle use. The population in the planning area is projected to increase by 35 percent between 2018 and 2040 (Colorado Department of Local Affairs 2017), and therefore it can be assumed that there will be a proportional increase in development and motor vehicle use and the associated emissions at the regional scale. Regional increases in emissions would be lessened by current and future EPA and CDPHE requirements for emission controls.

Emissions from past, present, and reasonably foreseeable future actions would disperse in the atmosphere and become part of the regional background pollutant levels. Because of the rural nature of the area, ambient background concentrations of air pollutants are expected to be relatively low, and air quality in the region is expected to remain in attainment for criteria pollutants. Cumulative air quality impacts from Alternatives A and C would not be substantial because the sum of the background levels and project-generated concentrations is expected to be less than the NAAQS for each pollutant.

Climate change is by nature a cumulative impact, and all GHG emissions play a role in contributing to global GHG concentrations and climate change. The following summary is adapted from the BLM Colorado Annual Air Resources Report 2.0 (BLM 2018), which is incorporated herein by reference. The future climate will reflect the warming caused by past anthropogenic emissions, future anthropogenic emissions, and natural variability. In the coming decades, the magnitude of climate change will be significantly affected by the overall trend in global GHG emissions. As global mean surface temperature increases, it is virtually certain that there will be more frequent hot and fewer cold temperature extremes over most land areas. Extremes in temperatures, precipitation and drought, and storm intensity will become more common, but these changes will not be uniform geographically. Oceans will continue to warm and acidify, levels of Arctic sea ice will continue to decrease, and sea level will continue to rise. In Colorado, projections indicate future warming. Precipitation trends are less clear, but most projections indicate an increase in winter precipitation. Trends in runoff and streamflow also are uncertain though projections generally indicate decreases in annual streamflow. Increased warming, drought, and insect outbreaks, all associated with climate change, will continue to increase wildfire risks and impacts to people and ecosystems.

GHG emissions associated with Alternatives A and C could contribute to cumulative global climate impacts. However, given the relatively low GHG emissions associated with Alternatives A and C, their contribution to global GHG concentrations and any resulting climate change would be low.

# 3.5. SURFACE, GROUND WATER, AND WATER QUALITY

**Issue 1: What are the water sources and water requirements for the Parkdale Quarry expansion?**

**Issue 2: Is dewatering anticipated to be required in any of the pits?**

**Issue 3: How would the Parkdale Quarry expansion affect water quality, quantity, and water rights?**

**Issue 4: How would surface water and groundwater be monitored for the proposed mine expansion**

## 3.5.1. Affected Environment

The analysis area for direct and indirect effects to surface water and groundwater resources is shown in Figure 3.5-1 and includes the area north of the Arkansas River within about 1.5 miles of the Sale Area. The area south of the Arkansas River is excluded from the analysis because the river forms a hydrologic boundary that is below the elevation of the pit floor and the potential level of groundwater drawdown effects that could be caused by the proposed mining operation.

The cumulative effects study area for water resource is shown on (Figure 3.5-2) and includes the sixth-level U.S. Geological Survey (USGS) hydrologic unit code (HUC) 12 sub-watersheds that contain the Sale Area or parts of the analysis area (Table 3.6).

**Table 3.6. USGS 6th Level Sub-Watersheds within the Water Resources Cumulative Effects Study Area**

| 4th Level Sub-Basin (HUC 8) | 5th Level Watershed (HUC 10) | 6th Level Sub-Watershed (HUC 12) | Sq. Mile |
|---|---|---|---|
| Arkansas Headwaters (11020001) | Tallahassee Creek – Currant Creek (1102000111) | Lower Cottonwood Creek (110200011108) | (32.8) |
| | | Lower Currant Creek (110200011109) | (35.3) |
| | | Tallahassee Creek (11020001110) | (50.2) |
| | Royal Gorge – Arkansas River (1102000114) | Five Point Gulch – Arkansas River (110200011407) | (47.4) |
| | | Royal Gorge (110200011409) | (26.0) |

### 3.5.1.1. Surface Water Resources

The Sale Area is located on the flank of Cactus Mountain and drains southwest toward Currant and Tallahassee Creeks. All drainages within the proposed pit disturbance are intermittent or ephemeral and flow for limited periods during most years in response to direct precipitation and snowmelt. Three named streams and nine springs are located within the analysis area. In downstream order, the streams include Cottonwood Creek, Currant Creek, and Tallahassee Creek. The springs Cactus Mountain Spring, Cactus Mountain South Spring, Parkdale Spring, and Parkdale South Spring within the Sale Area, and Willow Patch Spring, Currant Spring, Narrow Canyon Spring, Campbell King Spring 1, and unnamed spring 1 within the analysis area but outside of the Sale Area.

#### Cottonwood Creek

Cottonwood Creek is an intermittent stream that flows southeast from its headwaters in Park County to its confluence with Currant Creek about one mile north of the Sale Area. Its designated beneficial uses include Class 1 Coldwater Aquatic Life, Existing Recreation, Agriculture, and Water Supply. Streamflow and water quality data for Cottonwood Creek are available from USGS monitoring station 07094200. The station is located about 2.3 miles above the confluence with Currant Creek (Figure 3.5-3) and was monitored on 13 dates extending from January 1981 to September 1982. Reported instantaneous streamflows for the period of record ranged from 0.03 to 23 cubic feet per second (cfs). Monitored water quality parameters including field measurements of pH, specific conductance (SC), dissolved oxygen (DO), and temperature, and laboratory analyses for selected major ions, metals, and radionuclides generally met applicable standards and are presented in Appendix F. The mainstem of Cottonwood Creek from F6 Road to the confluence with Currant Creek is not 303(d) listed in the 2018 Colorado Integrated Report (CDPHE 2018) but it has not been assessed as meeting its designated beneficial uses because of a lack of supporting data.

#### Currant Creek

Currant Creek is a perennial stream that flows south through the western portion of the Sale Area to its confluence with Tallahassee Creek about 1,700 feet south of the Sale Area boundary. The stream channel is within the buffer zone and would not be disturbed by the proposed mining operation. The total length of Currant Creek within the Sale Area is 1.5 miles. Designated beneficial uses of the stream include Class 1 Coldwater Aquatic Life, Existing Recreation, Agriculture, and Water Supply. Streamflow and water quality data for Currant Creek are available from three stations located above its confluence with Cottonwood Creek (Figure 3.5-3). Stations 07094090 and 383150105225500 were monitored by the USGS. Station 21COL001-7110 was monitored by CDPHE. Available data from the stations are presented in Appendix F and summarized in Table 3.7. The monitored parameters generally met applicable water quality standards. The mainstem of Currant Creek from its source in Park County to the confluence of

Tallahassee Creek is not 303 (d) listed in the 2018 Colorado Integrated Report (CDPHE 2018) and with the exception of Existing Recreational Use, it is currently assessed as meeting its designated beneficial uses. Existing Recreational Use for Currant Creek was not assessed in the 2018 Colorado Integrated Report (CDPHE 2018).

**Table 3.7. Summary of Available Streamflow and Water Quality Data for Currant Creek**

| Station | Period of Record | Number of Samples | Range of Measured Streamflows | Water Quality Analyses |
|---|---|---|---|---|
| USGS 07094090 | 01/13/1981 – 09/21/1982 | 12 | 0.30 – 31 cfs | Field parameters, selected ions, metals, and radionuclides |
| USGS 383150105225500 | 4/22/72 | 1 | -- | Field parameters, major ions, nutrients, iron and manganese |
| CDPHE 21COL001-7110 | 08/17/2010 | 1 | -- | Field parameters, alkalinity, hardness, nutrients, selected ions and metals |

cfs = cubic feet per second

### Tallahassee Creek

Tallahassee Creek is a perennial stream that flows southeast through the southwestern portion of the Sale Area, where it flows through the existing Parkdale Quarry to its confluence with the Arkansas River. The stream channel within the buffer zone would not be disturbed by the proposed mine expansion, however, the current disturbance of the creek on private land south of the Sale Area would continue with continued mining. The total length of Tallahassee Creek within the Sale Area is 0.2 miles. Designated beneficial uses of the stream include Class 1 Coldwater Aquatic Life, Existing Recreation, Agriculture, and Water Supply. Streamflow and water quality data for Tallahassee Creek are available from four stations (Figure 3.5-3). Stations 07094300 and 382917105225200 were monitored by the USGS and are located above the confluences with Currant Creek and the Arkansas River, respectively. Stations 21COL001-Tallahassee04 and 21COL001-7115 are located above and below the confluence with Currant Creek, respectively and were monitored by CDPHE. Available data from the stations are presented in Appendix F and summarized in Table 3.8. The monitored parameters generally met applicable water quality standards. The mainstem of Tallahassee Creek from the confluence with South Tallahassee Creek to the confluence with the Arkansas River is not 303 (d) listed in the 2018 Colorado Integrated Report (CDPHE 2018) and is currently assessed as meeting its designated beneficial uses.

**Table 3.8. Summary of Available Streamflow and Water Quality Data for Tallahassee Creek**

| Station | Period of Record | Number of Samples | Range of Measured Streamflows | Water Quality Analyses |
|---|---|---|---|---|
| USGS 07094300 | 01/13/1981 – 09/21/1982 | 11 | 0.01 – 31 cfs | Field parameters, selected ions, metals, and radionuclides |
| USGS 382917105225200 | 06/03/1987 – 10/21/1992 | 14 | 0.14 – 44 cfs | Field parameters, alkalinity, TDS, nutrients, and metals |
| CDPHE 21COL001-Tallahassee04 | 0/14/1980 | 1 | -- | Field parameters, alkalinity, hardness TDS, TSS, nutrients, selected ions and metals |
| CDPHE 21COL001-7115 | 09/12/2005 – 06/21/2011 | 3 | -- | Field parameters, E. Coli, alkalinity, hardness, nutrients, major ions and metals |

cfs = cubic feet per second; TDS = total dissolved solids; TSS = total suspended solids.

### Springs

Fifteen springs are located within the analysis area (Figure 3.5-1). Cactus Mountain Spring, Cactus Mountain South Spring, Parkdale Spring, and Parkdale South Spring are located within the Sale Area. The other springs are located within the analysis area, but occur outside of the Sale Area. Locations, elevations, and discharge information for the springs are summarized in Table 3.9**.**

Springs within the Sale Area were surveyed by BLM on November 19, 2019. Cactus Mountain, Cactus Mountain South, and Parkdale springs were all flowing at about 0.25 gpm at the time of observation. Parkdale South Spring was dry. The springs are recharged by the infiltration of precipitation on their local watersheds, and they discharge from granitic bedrock in intermittent drainages on the southwest side of Cactus Mountain. BLM holds federal reserved water rights on. Parkdale Spring (# 1202149) and Cactus Mountain Spring (# 1202067) with decreed amounts of 0.22 cfs each gpm.

Willow Patch, Currant, and Narrow Canyon springs are located on BLM land north and northwest of the sale area (Figure 3.5-1). Willow Patch and Narrow Canyon springs were surveyed by BLM near the end of June in 2016. Both springs were flowing at the time of observation, but at very low rates (Table 3.9). Willow Patch Spring issues from a stream terrace adjacent to an intermittent tributary to Lower Cottonwood Creek. Narrow Canyon Spring is located in the channel of an intermittent tributary to Currant Creek. Current Spring was surveyed at the end of August in 2012 at which time it was dry.

Campbell King Spring 1, Tallahassee Ditch No. 2 Spring, Harvey Brothers Twelve Mile Spring, Wheaton College Springs 14, 15 and 16, and unnamed spring No. 1 are located on private land and only limited information including the spring locations and elevations are available. All of the springs have privately held water rights with the exception of unnamed spring 1 (Table 3.10).

**Table 3.9. Summary of Springs within the Analysis Area**

| Spring | Latitude | Longitude | Elevation (ft.) | Discharge (gpm) | Date Surveyed |
|---|---|---|---|---|---|
| Cactus Mountain Spring[1] | 38.50599 | -105.39281 | 6,480 | 0.25 | 11/19/2019 |
| Cactus Mountain South Spring[1] | 38.50336 | -105.40489 | 6,040 | 0.25 | 11/19/2019 |
| Parkdale Spring[1] | 38.5002 | -105.40104 | 6,140 | 0.25 | 11/19/2019 |
| Parkdale South Spring[1] | 38.49727 | -105.39662 | 5,920 | No Flow | 11/19/2019 |
| Willow Patch Spring[1] | 38.52571 | -105.42888 | 6,600 | 0.016 | 06/27/2016 |
| Currant Spring[1] | 38.51939 | -105.40823 | 6,200 | No Flow | 08/24/2012 |
| Narrow Canyon Spring[1] | 38.51673 | -105.40668 | 6,300 | Very Low | 06/27/2016 |
| Campbell King Spring 1[2] | 38.49140 | -105.37232 | 5,840 | Unknown | Not Surveyed |
| Tallahassee Ditch No. 2 Spring[3] | 38.49544 | -105.41055 | 5,920 | Unknown | Not Surveyed |
| Harvey Brothers Twelve Mile Spring[3] | 38.52156 | -105.39913 | 6,120 | Unknown | Not Surveyed |
| Wheaton College Spring 14[3] | 38.52503 | -105.35265 | 6,500 | Unknown | Not Surveyed |
| Wheaton College Spring 15[3] | 38.52173 | -105.36301 | 6,380 | Unknown | Not Surveyed |
| Wheaton College Spring 16[3] | 38.52605 | -105.37654 | 6,250 | Unknown | Not Surveyed |
| Cowan Spring No. 3[3] | 38.52891 | -105.36630 | 6,560 | Unknown | Not Surveyed |
| Unnamed Spring No. 1[2] | 38.50220 | -105.34645 | 6,200 | Unknown | Not Surveyed |

Sources: [1] BLM Royal Gorge Field Office (BLM 2019)
[2] National Hydrography Dataset (USGS 2005)
[3] Colorado Division of Water Resources (DWR) Water Rights Database (DWR 2020)

### Surface Water Rights

Surface water rights for the analysis area were compiled from a search of the Colorado Division of Water Resources (DWR) water rights database. A total of 19 surface water rights were identified within the analysis area. The water rights are summarized in Table 3.10. The downloaded records are presented in Appendix G.

**Table 3.10. Summary of Surface Water Rights within the Analysis Area**

| Water Right ID | Structure Name | Structure Type | Water Source | Decreed Amount (cfs) | Latitude | Longitude |
|---|---|---|---|---|---|---|
| 1200854 | Tallahassee Ditch No 1 | Ditch | Tallahassee Creek | 3.5 | 38.49612 | -105.414 |
| 1200570 | Pioneer Ditch Current Creek | Ditch | Currant Creek | 3.75 | 38.49867 | -105.408 |
| 1200573 | Third Ditch | Ditch | Currant Creek | 4 | 38.48973 | -105.389 |
| 1200928 | Cc Royal Gorge Intake | Ditch | Arkansas River | 19 | 38.47221 | -105.354 |
| 1200928 | Cc Royal Gorge Intake | Ditch | Arkansas River | 3.5 | 38.47221 | -105.354 |
| 1203021 | Currant Creek Minimum Flow | Min. Flow | Currant Creek | 1.9 | 38.49546 | -105.405 |
| 1203020 | Currant Creek Minimum Flow | Min. Flow | Currant Creek | 2 | 38.52139 | -105.4 |
| 1203011 | Tallahassee Creek Minimum Flow | Min. Flow | Tallahassee Creek | 1 | 38.48778 | -105.38 |
| 1202834 | Hasp Currant Creek Exchange | Reach | Currant Creek | 0 | 38.49545 | -105.405 |
| 1202835 | Hasp Tallahassee Creek Exchange | Reach | Tallahassee Creek | 0 | 38.48765 | -105.381 |
| 1200857 | Tallahassee Ditch No 2 | Spring | Tallahassee Creek | 14 | 38.49544 | -105.41055 |
| 1202149 | Parkdale Spring | Spring | Arkansas River | 0.0022 | 38.50029 | -105.40104 |
| 1202400 | Harvey Brothers Twelve Mile | Spring | Arkansas River | 3.2 | 38.52156 | -105.39913 |
| 1202067 | Cactus Mountain Spring | Spring | Arkansas River | 0.0022 | 38.50599 | -105.39281 |
| 1202549 | Wheaton College Spring 16 | Spring | Arkansas River | 0.022 | 38.52605 | -105.37654 |
| 1202247 | Campbell King Spring 1 | Spring | Arkansas River | 0.01 | 38.49140 | -105.37232 |
| 1202281 | Cowan Spring No 3 | Spring | Arkansas River | 0.013 | 38.52891 | -105.36630 |
| 1202548 | Wheaton College Spring 15 | Spring | Arkansas River | 0.0044 | 38.52173 | -105.36301 |
| 1202547 | Wheaton College Spring 14 | Spring | Arkansas River | 0.0088 | 38.52503 | -105.35265 |

Source: Colorado Division of Water Resources (DWR) Water Rights Database (CDWR 2020)

### 3.5.1.2. Groundwater Resources

Groundwater at the site is recharged by the infiltration of precipitation on upland areas and flows laterally away from high points following topography to discharge at streams and springs at lower elevations. The average precipitation at the site is about 17 inches annually (BLM 2017) with recharge to groundwater being estimated to be about 0.16 inches per year (ERM 2019).

Four hydrostratigraphic units are noted in the analysis area. They include alluvium instream channels and drainages, sedimentary rocks located north and south of the Sale Area, and granitic rocks that are divided into weathered granite near the surface and competent but fractured granite below a depth of about 20 feet (ERM 2019). Alluvium occurs as a thin veneer over granitic bedrock in intermittent drainages within the Sale Area and as thicker deposits adjacent to perennial streams including Currant Creek, Tallahassee Creek, and the Arkansas River. The sedimentary rocks rest unconformably on granite near the southern boundary of the Sale Area and are in fault contact with granite along the Parkdale Fault north of the Sale Area and unnamed faults near the southeast and southwest portions of the Sale Area (Figure 3.5-6). The faults are believed to cause some compartmentalization of groundwater flow across the structures by the disruption of stratigraphy and juxtaposition of rock types with different hydraulic characteristics.

Groundwater levels within the Sale Area have been evaluated by three monitoring wells installed by the Proponent (Figure 3.5-4). The wells were installed in cored boreholes that were drilled to depths of about 250 feet below ground surface (Table 3.11**)**. The observed depths to groundwater ranged from about 10 to 128 feet, and water levels in the wells fluctuated by up to 24 feet during four monitoring events completed between December 2018 and August 2019 (Table 3.12**)**. Water level elevations in the monitoring wells ranged from about 6,027 to 6,262 feet and indicate a southeast flow direction away from Cactus Mountain toward Tallahassee Creek and the Arkansas River. The observed groundwater elevations ranged from about 87 to 322 feet higher than the planned minimum pit floor elevation of 5,940 amsl for Alternative A. The need and method for dewatering the proposed quarry is discussed in Section 3.5.2.1, *Direct and Indirect Effects from Alternative A.*

**Table 3.11. Completion Details for Monitoring Wells and Exploration Boreholes**

| Well ID | Latitude | Longitude | Casing Elevation (ft. amsl) | Total Depth (ft. btoc) | Well Casing | Screened Interval (ft. btoc) |
|---|---|---|---|---|---|---|
| PD-1 | 38.496541° | -105.382685° | 6,252.7 | 239 | 2-inch PVC | 20-239 |
| PD-3 | 38.499052° | -105.399946° | 6,075.8 | 249 | 2-inch PVC | 20-249 |
| PD-10 | 38.504486° | -105.394678° | 6,271.6 | 251 | 2-inch PVC | 20-251 |

**Note**: Coordinate locations GCS- NAD 83

amsl = above mean sea level; btoc = below top of casing; ft. = feet

**Table 3.12. Summary of Measured Groundwater Levels in Monitoring Wells**

| Monitored Date | PD-1 | | PD-3 | | PD-10 | |
|---|---|---|---|---|---|---|
| | *Depth to Water (ft. btoc)* | *Water Level Elevation (ft. amsl)* | *Depth to Water (ft. btoc)* | *Water Level Elevation (ft. amsl)* | *Depth to Water (ft. btoc)* | *Water Level Elevation (ft. amsl)* |
| 12/7/2018 | 103.63 | 6149.11 | 47.52 | 6028.23 | 11.19 | 6260.37 |
| 12/11/2018 | 104.13 | 6148.61 | 47.55 | 6028.2 | 9.76 | 6261.8 |
| 5/14/2019 | 123.99 | 6128.75 | 38.38 | 6037.37 | 10.17 | 6261.39 |
| 8/29/2019 | 127.71 | 6125.03 | 49.19 | 6026.56 | 18.69 | 6252.87 |

amsl = above mean sea level; btoc = below top of casing; ft. = feet

Information about the permeability (hydraulic conductivity) and transmissivity of the granitic rocks within the Sale Area are available from single well tests performed in the monitoring wells listed in Table 3.11. The results of the tests are summarized in Table 3.13 and indicated hydraulic conductivity values ranging from 0.0019 to 0.0065 ft./day (ERM 2019). The average hydraulic conductivity from the three tests was calculated to be 0.0039 ft/d, which is assumed to be the best estimate of the average hydraulic conductivity of the fractured granitic rocks below a depth of about 20 feet (ERM 2019).

Site-specific hydraulic conductivity data are not available for weathered granite, sedimentary rocks or alluvium near the proposed quarry expansion, but typical values for weathered granite range from about 0.9 to 15 ft/day (Domenico and Schwartz 1990). Typical hydraulic conductivity values for fractured sandstone range from about 0.003 to 3 ft/day, and typical values for alluvium range from about 3 to 300 ft/day (Spitz and Moreno 1996).

**Table 3.13. Summary of Pumping Test Results**

| Well ID | Average Pumping Rate (gpm) | Pumping Duration (min) | Maximum Drawdown (ft.) | Saturated Thickness (ft.) | Transmissivity (ft.$^2$/d) | Hydraulic Conductivity (ft./d) |
|---|---|---|---|---|---|---|
| PD-1 | 0.136 | 110 | 10.5 | 134.9 | 0.26 | 0.0019 |
| PD-2 | 0.716 | 74 | 99.8 | 201.4 | 0.63 | 0.0031 |
| PD-3 | 0.960 | 102 | ≈128 | 241.2 | 1.57 | 0.0065 |

ft. = feet; ft.$^2$/d = foot squared per day; gpm = gallons per minute; min = minutes

Groundwater quality data for the Sale Area are available from six samples that were collected from the monitoring wells listed in Table 3.11. The wells were monitored for field parameters, major ions, dissolved metals, and radionuclides during two sampling rounds completed in December 2018 and May 2019. Monitoring results indicate that groundwater at the site has near neutral pH (6.64-7.71) low to moderate concentrations of total dissolved solids (318-437 mg/l) and generally meets water quality standards for drinking water with the exception of gross alpha radiation and uranium (ERM 2019). Groundwater quality data for the site are presented in Appendix F.

In addition to site-specific groundwater data that were developed for the Sale Area, well records from the Colorado Division of Water Resources (DWR) were reviewed to identify other wells and groundwater users within the analysis area. The database search found 97 wells that were listed as either being constructed or replaced within the area of interest (Figure 3.5-5). The majority of wells are reported as being located east and northeast of the Sale Area in areas that are underlain by cretaceous-age sedimentary rocks **(**Figure 3.5-6). Eight of the wells are reported to be located within the granitic rocks on the north side of Cactus Mountain, but review of aerial photographs and well construction reports indicates that the locations are misreported and that the wells are actually completed in sedimentary rocks north of the Parkdale Fault **(**Figure 3.5-6). The exact locations of the wells are unknown, but with the exception of the three monitoring wells installed by the Proponent, no wells are located in the granite within the fault block defined by the Parkdale Fault and unnamed faults 1 and 2 **(**Figure 3.5-6). A summary of primary water uses for wells in the analysis area is presented in Table 3.14. DWR well records are presented in Appendix G.

An analysis of the completion water levels for wells reported in the DWR database indicates that groundwater elevations in the analysis area vary widely, ranging from 5,657 to 7,041 feet elevation. The variation occurs over relatively short distances and often exceeds 100 to 200 feet between wells that are located within 1,000 to 2,000 feet of each other. The accuracy of the water level analysis is affected by a number of factors including the accuracy of the reported well locations and surface elevations, completion details for individual wells, and the range of time over which the groundwater levels were measured, but the reported variability is consistent with groundwater systems in low-permeable rocks that are poorly inter connected over short distances.

**Table 3.14. Summary of Primary Water Uses for Wells within the Analysis Area**

| Primary Water Use | Count |
|---|---|
| Commercial | 3 |
| Domestic | 56 |
| Domestic, Industrial | 1 |
| Domestic, Irrigation | 1 |
| Domestic, Stock | 21 |
| Domestic, Storage | 1 |
| Household Use Only | 7 |
| Stock | 4 |
| Monitoring | 2 |
| Other | 1 |
| **Total** | **97** |

## 3.5.2. Environmental Effects

### 3.5.2.1. Direct and Indirect Effects from Alternative A

Four issues for surface water and groundwater resources were determined during the scoping process for the proposed Parkdale Quarry Expansion. The issues are related to: (1) the water usage requirements and sources of water for the proposed mine expansion; (2) the need for active dewatering of the pits to facilitate mining in the expansion area; (3) the potential effects of mining in the Sale Area on surface water and groundwater quality, quantity, and current water users; and, (4) how would the existing water monitoring plan be modified to incorporate mining in the expansion area.

### Issue 1: Water Usage Requirements and Sources.

Water use at the current quarry operation requires about 1,500 gallons per minute (gpm), most of which is recycled water that is used at the wash plant or is applied to roads for dust control. It is expected that water usage under Alternative A would be similar to current usage by the quarry. Water for the quarry is obtained from tributary groundwater that collects in the completed alluvial pit and is augmented as needed by water from Tallahassee Creek under a state reviewed and approved withdrawal permit. Water shares are leased from the Board of Water Works of Pueblo, the Twin Lakes Reservoir and Canal Company, and the Cañon City Water Department to allow the use of groundwater and surface water by the mine. Alternative A would continue to use these sources of water for mining operations in the Sale Area and the potential effects of water usage under Alternative A would be the same as the effects of the currently permitted usage.

### Issue 2: Need for Active Dewatering of the Pits.

The need for active dewatering of the pits to facilitate mining in the Sale Area was evaluated based on observations on groundwater inflow to the current quarry operation and scoping-level calculations of inflow performed by ERM (2019) and Whetstone (2019). The analysis by ERM used two types of analytical calculations: one for southwest linear flow towards the quarry highwall and one for radial flow to a semicircle representing the northeast portion of the quarry. Both calculations assumed the following conditions:

- The hydraulic conductivity of the granitic rocks is equal to the average of the testing data in Table 3.13 (i.e., 0.0039 ft./day).
- Specific yield of the granitic rocks is equal to 0.01.
- The quarry is instantaneously excavated to full depth at time zero.
- Groundwater drawdown at the quarry wall would be 300 feet.
- The thickness of the permeable fractured bedrock is 500 feet.
- Groundwater flow is horizontal.
- The aquifer has homogeneous characteristics, is unbounded, and has infinite aerial extent.

The analysis by Whetstone used the groundwater modeling software MODFLOW-SURFACT V.4.0- (Hydrogeologic 2011) and a similar set of assumptions with the following exceptions:

- The aquifer is bound (no flow) to the south by the Arkansas River. The river elevation is below the planned elevation of the pit floor and therefore the cone of depression caused by groundwater drawdown cannot expand past this boundary.
- The aquifer is bound (no flow) by Currant and Tallahassee Creeks where the elevations of the drainages are below the minimum level of the planned pit floor.

The analyses performed by ERM and Whetstone generally provide similar estimates of groundwater inflow to the quarry. ERM estimated that inflows during mining were likely to range from 15 to 25 gpm (ERM 2019). These values are consistent with observed flows from the existing quarry face, which is about 270 feet high and typically has little or no seepage except after precipitation events and during spring snowmelt. Whetstone estimated an inflow rate of 35 gpm to the quarry at its full extent after 100 years of mining (Whetstone 2019). This estimate is considered to be conservatively high because groundwater systems in fractured granite bodies with low hydraulic conductivity tend to be poorly connected over broad areas and the Parkdale and unnamed fault 2 are likely to act as boundaries to the north and east (Whetstone 2019). Under any circumstance, the predicted inflows are low enough to not be of operational consequence, and advanced dewatering of the quarry by pumping from groundwater wells would not be required to facilitate mining. Free flowing groundwater that enters the quarry during mining would be routed to settling ponds to ensure that it meets applicable standards for suspended sediment and turbidity prior to re-infiltration to groundwater or being discharged to either Currant or Tallahassee Creek.

### Issue 3: Potential Effects of Mining in the Sale Area on Surface Water and Groundwater Quality, Quantity, and Current Water Users.

The potential effects of Alternative A on surface water and groundwater quality, quantity, and current water users in the analysis area were evaluated using the following methods: stormwater runoff modeling by Whetstone (2020, Appendix F), the previously discussed scoping-level calculations and modeling by ERM and Whetstone (ERM 2019, Appendix K), Whetstone 2019 (Appendix F), evaluation of the hydrogeologic setting of wells and springs relative to the proposed mine expansion area, comparison of groundwater quality data from monitoring wells in the Sale Area to water quality data for Currant and Tallahassee Creeks, and comparison of the estimated area of potential groundwater drawdown related to mining to the locations of wells and groundwater users identified in the DWR database.

Development of Alternative A could affect groundwater levels and availability near the Sale Area. The quarry would be developed in a structurally isolated block that is bound to the north by the Parkdale Fault and to the east and west by unnamed faults 1 and 2. The drainages for Currant Creek, Tallahassee Creek, and the Arkansas River also form hydrologic boundaries to the west and south of the Sale Area because their elevations are below the level of the planned pit floor and the cone of depression associated with mine dewatering will not be able to expand into areas that are below the lowest elevation that would be dewatered. The streams also act as source of groundwater recharge or can be locations of groundwater discharge that maintain groundwater elevations at constant levels adjacent to the waterbodies.

The potential for impacts to existing groundwater users was evaluated using scoping-level calculations and modeling by ERM (2019, Appendix K) and Whetstone (2019, Appendix F). The analyses were used to define the area in which groundwater levels could be theoretically reduced by 5 feet or more after 100 years of mining (Figure 3.5-5) and incorporates numerous simplifying but conservative assumptions. The most important assumptions that affect the results of the evaluation are that groundwater near the proposed quarry expansion is well connected over a broad area that has consistent hydrogeologic properties, and that groundwater levels are drawn-down to the lowest level of the final pit floor at the start of mining. In reality, available water level data from DWR well records suggest that groundwater is poorly connected over relatively short distances, and drawdown associated with pit dewatering would occur gradually over the expected 100-year life of the mine. Other factors that result in overprediction of drawdown in areas distal to the proposed quarry include hydrologic boundaries that are not considered such as the Parkdale Fault, unnamed fault 2, and the Mikesell Gulch Fault (Figure 3.5-6). Unnamed fault 1 has less effect on the analysis because the drainage for Currant Creek is simulated as a no-flow boundary in the Whetstone model (Whetstone 2019, Appendix F) and is located in the same general area as unnamed fault 1. Sedimentary rocks that are in fault contact with the granite north and south of the Sale Area are expected to have higher hydraulic conductivity than the granite and are also recharged by water from perennial sections of Currant and Cottonwood creeks that lose flow to groundwater and become intermittent near State Highway 9. A number of smaller intermittent drainages located northeast of the highway also contribute runoff that infiltrates into to the sedimentary rocks. The higher hydraulic conductivity of the sedimentary rocks and additional recharge from surface water are not considered in the analyses by ERM and Whetstone, which tends to increase the conservatism of the predicted drawdowns along the State Highway 9 corridor.

The results of the analytical calculations and numerical model for Alternative A predict groundwater drawdowns of between 5 and 30 feet for wells located in sedimentary rocks north of the Parkdale Fault **(**Figure 3.5-6). This prediction is considered to be a conservative overestimation based on the previously discussed rational. With the exceptions of wells 276232, 238087, 30210MH and 203262, wells that are located within the zone of potential impacts east of the Sale Area in the fault block between unnamed fault 2 and the Mikesell Gulch Fault and southeast of the Mikesell Gulch Fault have water level elevation that are below the lowest elevation of the proposed pit or they are located on the opposite side of Bumback Gulch which has surface elevations below the level of the proposed pit. These wells have negligible potential to be impacted by drawdown related to mine dewatering. Wells 276232 and 238087 have reported water level elevations of 6,164 feet and predicted drawdown at the well locations is about 25 feet. Wells, 30210MH and 203262 have reported water level elevations between 6,194 and 6238 feet and drawdown in this area is predicted to be about 8 feet. Potential drawdown impacts to wells would be permanent to the extent that they would actually occur.

Alternative A would lower groundwater levels in the quarry area by up to about 300 feet and would result in the elimination of flows from Parkdale South, Cactus Mountain, and Cactus Mountain South Springs, which would be in, or immediately adjacent to the pit. BLM holds federal reserved water rights on Cactus Mountain Spring and Parkdale Spring, would cease to flow and the water rights would be affected. This impact would be permanent and major, but could be mitigated by development of surface water impoundment(s) or the installation of groundwater wells for wildlife and livestock watering within the Sale Area as the impacts are observed to occur. Drawdown of groundwater levels outside of Sale Area under Alternative A also has the potential to reduce or interrupt flows from springs located within the zone of potential impacts shown on **(**Figure 3.5-6) which would affect the associated water rights. The impacts would be permanent and major but could be mitigated by the installation of wells or construction of surface water impoundments should the occur.

Groundwater quality under Alternative A could be affected in the area of the planned quarry. The potential impacts include increases in total dissolved solids (TDS) and nitrogen species (nitrate and nitrite) from mining and controlled subsurface blasting. These impacts would be localized and temporary during active mining and may be mitigated by monitoring and modification of mining practices if impacts are observed. Alternative A is not expected to affect the quality of groundwater accessed by existing users at wells or springs outside of the Sale Area.

The Sale Area currently drains south to southwest with the majority of surface water runoff flowing to Currant Creek and Tallahassee Creek through three main drainage areas (Figure 3.5-1). Once mining is complete, the topography of the quarry will generally slope in the same direction and drainage channels will be excavated into the quarry floor to maintain the current general patterns of runoff. The drainage channels will be constructed with a channel profile and sinuosity similar to that of natural drainages in Webster Park that feed into the south side of the Arkansas River. Under Alternative A, streamflow and water quality could be affected in Currant and Tallahassee creeks. Development of the quarry would modify the topography of areas tributary to the creeks and affect the timing and volume of runoff reporting to the creeks.

Potential impacts to surface water flow rates in Currant Creek and Tallahassee Creek were evaluated using HydroCAD modeling software and the NRCS TR-55 method. The models estimated the surface water runoff from the Sale Area under existing conditions, which were then compared to the potential runoff after mining disturbance and reclamation. The stormwater runoff modeling (Whetstone 2020, Appendix F) indicates that the reduction of slopes in the quarry area and change in vegetation after reclamation could increase the volume of runoff reporting to the creeks by 160% for the 100-year precipitation event and by 220% for the 10-year precipitation event and could consequently decrease evapotranspiration and infiltration of precipitation and snowmelt to groundwater. Decreased infiltration to groundwater is expected to result in decreased baseflows to the creeks, which would be partially offset by increased streamflows during major storm events. Runoff from the site during mining may have increased turbidity, sediment, and elevated concentrations of nitrate and nitrite, but would be routed to settling ponds and monitored to ensure that it meets applicable water quality standards prior to being discharged to either Currant or Tallahassee Creek. Runoff from the reclaimed quarry is expected to be similar in quality to the pre-mining condition and would not require settling before being allowed to flow into Current and Tallahassee creeks. Potential impacts to streamflows in Currant and Tallahassee creeks could decrease over time as vegetation returns to native pinyon-juniper canopy. The increase in runoff predicted by the stormwater modeling is small relative to the total runoff from the Currant and Tallahassee Creek watershed (Whetstone 2020, Appendix F) because the modeled area (1.6 mi$^2$) represents less than 1.4% of the total watershed area for the Tallahassee Creek-Currant Creek Watershed (118.3 $mi^2$). The annualized increase in runoff in Tallahassee Creek below the Sale Area, calculated from the probability-weighted changes in runoff for the 2-yr, 5-yr, 10-yr, 25-yr, 50-yr, and 100-yr storms, is 0.067 cfs (Whetstone 2020, Appendix F). Potential impacts to water quality would be mitigated by the use of BMPs to control turbidity, sediment, and nitrogen in runoff and by monitoring to ensure that runoff collected in sediment ponds meets applicable water quality standards prior to release to the surrounding drainages.

### Issue 4: How would surface water and groundwater be monitored for the proposed mine expansion?

Mining in the Sale Area under Alternative A has the potential to reduce groundwater levels within the area shown on Figure 3.5-5 and reduce water availability to nearby wells and springs. Potential impacts to groundwater quality may include increased TDS, nitrate, and nitrite concentrations within the mining area. Potential impacts to Currant and Tallahassee Creeks under Alternative A include increased runoff during storm events and the alteration of patterns of streamflow. Water quality impacts to Currant and Tallahassee creeks may include increased levels of turbidity, TDS, suspended solids, and nitrogen species (nitrate and nitrite) in runoff and baseflow from the mining area. A monitoring plan would be developed that requires operational and post reclamation monitoring in areas adjacent to the mine to detect changes in groundwater levels that could affect groundwater availability to springs and wells and allow for the timely mitigation of impacts if any. Monitoring would also be implemented between the proposed quarry and Currant and Tallahassee creeks to detect changes in shallow groundwater chemistry that could affect baseflow reporting to the creeks. Potential impacts to surface water would be evaluated by establishing streamflow and water quality monitoring stations on Currant and Tallahassee creeks. The monitoring plan would also require monitoring of spring flows and water quality for springs located within the area of potential impacts south of the Parkdale Fault (Figure 3.5-6).

### *Protective/Mitigation Measures*

Potential impacts to water resources under Alternative A include:

- Alteration of groundwater levels and reduction of groundwater availability to users and springs located within the area shown on Figure 3.5-5.
- Elimination of spring flows within the proposed quarry footprint and elimination of the water source for the Federal Reserved Water Right on Parkdale and Cactus Mountain Springs.
- Alteration of groundwater quality near the proposed quarry including increased concentrations of TDS, nitrate and nitrite.

- Increased runoff to Currant and Tallahassee creeks during storm events and alteration of patterns of streamflow caused by changes in runoff and baseflow from the proposed quarry area.
- Alteration of water quality in Currant and Tallahassee Creeks including increased turbidity and concentrations of TDS, suspended solids, nitrate and nitrite.

### *Mitigation Measure W1- Develop Water Monitoring Plan*

Mitigation to protect groundwater availability to users near Alternative A would include monitoring to detect changes in groundwater levels outside of the Sale Area to allow for the timely replacement of affected water supplies by the Proponent by drilling new wells or deepening existing wells.

Mitigation of potential impacts to streamflow and surface water and groundwater quality would include monitoring to detect changes to allow for adaptive management of mining practices if adverse impacts are observed.

If monitoring indicates that reductions in spring flows or streamflows are occurring and that these reductions are probably caused by mine induced drawdown, the following measures would be implemented:

1) BLM would evaluate the available information and determine if mitigation is required;
2) If mitigation is required, Proponent would be responsible for preparing a detailed, site-specific plan to enhance or replace the impacted water resources. The mitigation plan would be submitted to BLM identifying drawdown impacts to surface water resources. Mitigation would depend on the actual impacts and site specific conditions and could include a variety of measures including flow augmentation, and on-site or off-site improvements). Methods for providing a new water source or improving an existing water source may include, but are not limited to:
    a. Installation of a water supply pump in an existing well (e.g., monitoring well) – this could provide replacement water for directly impacted Cactus Mountain Spring and Parkdale Spring
    b. Installation of a new water production well (expensive)
    c. Piping water from a new or existing source
    d. Installation of a guzzler
    e. Enhanced development of an existing seep to promote additional flow
    f. Fencing or other protection measures for an existing seep to maintain flow

An approved site-specific mitigation plan would be implemented followed by monitoring and reporting to measure the effectiveness of the implemented measures. If initial implementation were unsuccessful, the BLM may require implementation of additional measures.

***Effectiveness***

Feasibility and success of mitigation would depend on site-specific conditions and details of the monitoring and mitigation plan.

***Mitigation Measure W2 – Loss of Springs and Federal Reserved Water Right***

Mitigation of the springs and Federal Reserved Water Right that would be eliminated by Alternative A would include the development of alternative sources of water within the reclaimed quarry footprint including the creation of small surface water impoundments that could be used by wildlife. Alternatively, the BLM may require the proponent to provide alternative water supply for wildlife though the pumping and delivery of water from existing groundwater production wells to surface water impoundments or wildlife guzzler installations.

***Effectiveness***

Feasibility and success of mitigation would depend on site-specific conditions and details of the mitigation plan.

***Residual Effects***

The area of residual mine-related groundwater drawdown is predicted to persist for the foreseeable future around the mine as shown in Figure 3.5-5. Successful implementation of mitigation measures would minimize or eliminate most residual adverse effects to water resources. However, a permanent reduction of groundwater levels potentially could occur and would comprise a residual adverse effect to individual surface water locations, but would have little effect on the overall water balance of the hydrologic basins.

### 3.5.2.2. Direct and Indirect Effects from Alternative B

Under Alternative B, the proposed mineral Sale Area would not be developed, and direct and indirect effects to groundwater and surface water resources would not occur beyond those effects resulting from previously authorized disturbance. Under this alternative, the natural watershed in Sale Area would not be disturbed and mining related changes to the patterns of surface water and groundwater flow would not occur.

### 3.5.2.3. Direct and Indirect Effects from Alternative C

**Issue 1: Water Usage Requirements and Sources.**

Under Alternative C, the water usage requirements and the sources of water would be the same as for Alternative A. It is expected that the quarry operation would require approximately 1,500 gpm of water for dust suppression and aggregate processing. The water would be obtained from the pit lake in the previously mined alluvium quarry and would be augmented as needed by water from Tallahassee Creek under a state reviewed and approved withdrawal permit.

### Issue 2: Need for Active Dewatering of the Pits.

Under Alternative C, the need for dewatering of the mine pits would be the same as for Alternative A. The average groundwater seepage from the working pit face is expected to range from about 15 to 35 gpm, similar to what is observed in the current quarrying operation, and the pits would not require active dewatering to facilitate mining.

### Issue 3: Potential Effects of Mining in the Sale Area on Surface Water and Groundwater Quality, Quantity, and Current Water Users.

Alternative C could affect groundwater levels and availability near the Sale Area. The area of potential impacts would be similar in size to Alternative A, but offset to the east (Figure 3.5-7). The results of the numerical model for Alternative C predict groundwater drawdowns of between 5 and 75 feet for wells located in sedimentary rocks north of the Parkdale Fault **(**Figure 3.5-6). This prediction is considered to be a conservative overestimation based on the previously discussed rational. With the exceptions of wells 276232, 238087, 30210MH and 203262, wells that are located within the zone of potential impacts east of the Sale Area in the fault block between unnamed fault 2 and the Mikesell Gulch Fault and southeast of the Mikesell Gulch Fault have water level elevation that are below the lowest elevation of the proposed pit or they are located on the opposite side of Bumback Gulch which has surface elevations that would be below the level of the pit floor. These wells have negligible potential to be impacted by drawdown related to mine dewatering. Wells 276232 and 238087 have reported water level elevations of 6,164 feet and predicted drawdown at the well locations is about 65 feet. Wells, 30210MH and 203262 have reported water level elevations between 6,194 and 6238 feet and drawdown in this area is predicted to be about 22 feet. Potential drawdown impacts to wells under Alternative C would be permanent to the extent that they would actually occur.

Alternative C would lower groundwater levels in the quarry by up to 300 feet and could decrease or eliminate flows from Parkdale, Parkdale South, Cactus Mountain, and Cactus Mountain South springs. BLM's federal reserved water rights on Cactus Mountain Spring and Parkdale Spring may be adversely affected. This impact has the potential to be permanent and major if it occurs, but could be mitigated by the development of surface water impoundment(s) or the installation of groundwater wells for wildlife and livestock watering. Drawdown of groundwater levels outside of Sale Area under Alternative C also has the potential to reduce or interrupt flows from springs located within the zone of potential impacts shown on Figure 3.5-7 which would affect the associated water rights. The impacts would be permanent and major, but could be mitigated by the installation of wells or construction of surface water impoundments should they occur.

Similar to Alternative A, groundwater quality near the quarry could be affected by mining under Alternative C. The potential impacts include increases in total dissolved solids (TDS) and nitrogen species (nitrate and nitrite) from mining and controlled subsurface blasting. These impacts would be localized and temporary during active mining and may be mitigated by monitoring and modification of mining practices if impacts are observed. Alternative C is not expected to affect the quality of groundwater accessed by existing wells outside of the Sale Area but could affect the quality of water discharged from Campbell King Spring 1.

Under Alternative C, streamflow and water quality could be affected in Tallahassee Creek but impacts are not expected for Currant Creek. Development of the quarry under Alternative C would modify the topography of areas tributary to Tallahassee Creek and affect the timing and volume of runoff reporting to the stream. Increased runoff from the site during mining may have elevated levels of turbidity, sediment, nitrate, and nitrite, but would be routed to settling ponds and monitored to ensure that it meets applicable water quality standards prior to being discharged to the Tallahassee Creek drainage or the intermittent drainage above Campbell King Spring 1. Potential impacts to streamflow in Tallahassee Creek would include increased runoff during storm events which would be permanent, but negligible to minor because the disturbed mining area would represent only less than 1 percent of the total watershed. Potential impacts to the water quality of the stream would be mitigated by the use of BMPs to control turbidity, sediment, and nitrogen in runoff and by monitoring to ensure that runoff collected in sediment ponds meets applicable water quality standards prior to release.

### Issue 4: How Would the Existing Water Monitoring Plan be Modified to Incorporate Mining in the Expansion Area?

Under Alternative C, a monitoring plan would be developed that would be similar to the one for Alternative A. The monitoring plan would require operational and post reclamation monitoring in areas adjacent to the mine to detect changes in groundwater levels that could affect groundwater availability to springs and wells and allow for the timely mitigation of impacts if any. Monitoring would also be implemented between the proposed quarry and Tallahassee Creek to detect changes in shallow groundwater chemistry that could affect baseflow reporting to the creeks. Potential impacts to surface water would be evaluated by establishing a streamflow and water quality monitoring stations on Tallahassee Creek. The monitoring plan would also require monitoring of spring flows and water quality for springs located within the area of potential impacts south of the Parkdale Fault (Figure 3.5-6).

### *Protective/Mitigation Measures*

Mitigation of direct and indirect impacts to water resources under Alternative C would be the same as for Alternative A and would include:

- Monitoring to detect changes in groundwater levels outside of the Sale Area and allow for timely replacement of affected water supplies by the Proponent by drilling new wells or deepening existing wells.
- The development of alternative sources of water including surface impoundments within or near the Sale Area to replace or augment spring flows that could be reduced by mining.
- Monitoring of streamflow and surface water and groundwater quality to detect changes and allow for adaptive management of mining practices if adverse impacts are observed.

***Residual Effects***

Residual effects are anticipated to be similar to those discussed under Alternative A.

## 3.5.3. Cumulative Effects Analysis

The CESA for water resources is the Lower Currant Creek, Royal Gorge, Five Point Gulch-Arkansas River, Tallahassee Creek, and Lower Cottonwood Creek HUC 12 subwatersheds. Reasonably foreseeable future conditions that could cumulatively impact water resources include the projected population increase (36 percent over the next 20 years [Colorado Department of Local Affairs 2017]) combined with the current trend in climate change which may combine to create an overall decrease in water quantity.

# 3.6. TERRESTRIAL WILDLIFE

**Issue 1: How would the Parkdale Quarry expansion affect the availability and quality of habitat and nesting sites for migratory bird species?**

**Issue 2: How would the Parkdale Quarry expansion affect the availability and quality of habitat for special status wildlife species?**

**Issue 3: How would the Parkdale Quarry expansion affect the availability and quality of habitat for bighorn sheep?**

## 3.6.1. Affected Environment

The analysis area for direct and indirect effects on wildlife and aquatic resources is the Mine Plan boundary. The CESAs for wildlife resources are described in Section 3.6.3, *Cumulative Effects Analysis,* and vary depending on the species. CESAs were determined based on wildlife use within the mineral sale regional location and important seasonal habitats for species such as Rocky Mountain bighorn sheep.

Information regarding wildlife species and habitat within the study area and CESAs was obtained from a review of existing published sources, site-specific wildlife and habitat surveys, BLM, CPW, and U.S. Fish and Wildlife Service (USFWS) file information.

### 3.6.1.1. Existing Habitat

The proposed mineral Sale Area is located near Parkdale, Colorado, adjacent to the existing Parkdale Quarry, and encompasses the southwest side of Cactus Mountain. Elevations in the mineral material Sale Area range from approximately 5,790 ft. to 6,960 ft. Existing wildlife species and habitats are typical of the Front Range foothills of southeastern Colorado (Cedar Creek 1997).

As indicated in Table 3.15, National Land Cover Data (NLCD) indicates that the majority of wildlife habitat in the study area consists primarily of evergreen forest (53 percent) and shrub/scrub (47 percent) (Figure 3.6-1, Appendix C). Field surveys confirmed that the study area is dominated by pinyon-juniper evergreen forest and shrub/scrub consisting predominantly of pinyon pine (*Pinus edulis*), Rocky Mountain juniper (*Juniperus scopulorum),* one-seed juniper *(Juniperus monosporum),* Gambel oak (*Quercus gambelii*) and mountain mahogany (*Cercocarpus montanus*) (ICF 2019). Piñon-juniper habitat in the study area may provide an important supply of pine nuts and juniper berries as a winter food source for wildlife. Wildlife commonly found in the piñon-juniper habitat include western scrub-jay, juniper titmouse, gray flycatcher, blacktail jackrabbit, cliff chipmunk, mule deer and elk. Predators common in this habitat include gray foxes and raptors such as red-tailed hawks (Marcus et. al. 2011).

Mountain scrub/shrubland habitat provides valuable food and cover for many wildlife species. Many shrub species produce edible fruits, and they provide a large selection of forage types. Gambel oak acorns are an important mast crop in many areas. Birds such as band-tailed pigeon, wild turkey, Lewis's woodpecker, Steller's jay, western scrub-jay, and green-tailed towhee feed on the acorns. Other birds such as the Virginia's warbler utilize mountain shrub habitat for resting, feeding, and nesting. Dusky flycatcher, Virginia's warbler, and green-tailed towhee are associated with Gambel oak and other shrub habitat (BLM 2017).

**Table 3.15. National Land Cover Data (NLCD) Designations within the Study Area**

| Mineral Sale Area | Evergreen Forest (acres) | Shrub/Scrub (acres) | Total[1] (acres) |
|---|---|---|---|
| Phase 1 – West Pit | 29.5 | 51.2 | 80.7 |
| Phase 2 – West Central Pit | 106.5 | 61.1 | 167.6 |
| Phase 3 – Central Pit | 112.1 | 124.5 | 236.6 |
| Phase 4 – East Central Pit | 73.4 | 38.9 | 112.3 |
| Phase 5 – East Pit | 48.7 | 58.6 | 107.3 |
| **Total** | **370.2** | **334.3** | **704.5** |

Source: USGS 2016

[1] Totals may vary due to rounding.

The study area consists of very steep rugged terrain. Rock outcrops and cliffs existing in the mineral Sale Area are numerous and may serve as important habitat for yellow-bellied marmot, rock squirrel, bush-tailed woodrat, and swallows. Ledges and cavities in cliff areas could provide suitable nesting habitat for cliff-nesting raptors such as red-tailed hawk, prairie falcon, golden eagle, and great horned owl.

The study area is situated within the fifth level (Hydrologic Unit Code, HUC: 1102000111) Tallahassee Creek-Currant Creek watershed of the Arkansas Headwaters sub-basin (11020001). Perennial streams located within the watershed are Currant Creek, Cottonwood Creek, North Tallahassee Creek, Tallahassee Creek, Thirtyone Mile Creek, Fear Creek, South Tallahassee

Creek, Dicks Creek, North Waugh Creek, Paris Creek, Squaw Creek, Middle Tallahassee Creek, Kelly Creek, Freshwater Creek, Salt Creek, and West Waugh Creek. All Perennial/intermittent streams originating from this watershed drain into Tallahassee Creek. Tallahassee Creek is a tributary of Arkansas River (BLM 2017).

An analysis of National Hydrology Data (NHD) and field surveys confirm that sources of available water for wildlife consumption are limited within the study area (USGS 2019, ICF 2019). Surface water features include a few intermittent streams, Currant Creek, and Tallahassee Creek (Table 3.16**)**. Tallahassee Creek supports narrow strips of mesic meadows and forest/shrub wetland vegetation along its banks. Riparian-specific features include willow and herbaceous riparian habitats (ICF 2019). The majority of the runoff in the study area flows to Currant Creek and Tallahassee Creek through three main intermittent drainage areas. The Arkansas River is located to the south of the Sale Area and the existing Parkdale Quarry.

**Table 3.16. Surface Water and Wetland Resources within the Study Area**

| Mineral Sale Area | Intermittent Stream (miles) | Riverine Wetlands (acres) |
|---|---|---|
| Phase 1 – West Pit | 0.28 | 0.7 |
| Phase 2 – West Central Pit | 1.36 | 3.2 |
| Phase 3 – Central Pit | 2.54 | 6.1 |
| Phase 4 – East Central Pit | 0.64 | 1.5 |
| Phase 5 – East Pit | 0.47 | 1.1 |
| **Total** | **5.29** | **12.6** |

Sources: USGS 2019; USFWS 2019

### 3.6.1.2. Big Game Species

Big game species are managed by CPW, with range designations and migration corridors for each species delineated across the entire state. CPWs strategic plan defines that game populations are to be managed in accordance with a Data Analysis Unit (DAU) plan. A DAU is the geographic area that represents the year-round range of a big game herd and includes all of the seasonal ranges for a specific herd. Each DAU is typically composed of several Game Management Units (GMU). Mule deer (*Odocoileus hemionus*), bighorn sheep (*O. canadensis canadensis*), black bear (*Ursus americanus*) and mountain lion (*Puma concolor*) are the only big game animals likely to be found in the study area (Cedar Creek 1997). The study area occurs entirely within CPW's Management Area 13, specifically big game hunting unit 58 (CPW 2019a).

Rocky Mountain bighorn sheep and mule deer are the primary big game species within the study area. Mule deer and big horn sheep population numbers fluctuate from year-to-year based on habitat conditions. Limiting factors within the study area include water availability, and amount of suitable quality habitat. Seasonal use and movement patterns in the vicinity of the study area depends on weather and forage availability and quality.

### Mule Deer

Mule deer are distributed statewide in all ecosystems in Colorado. They are most abundant in shrublands in rough, broken terrain where abundant food and cover are provided (Cedar Creek 1997). The study area is located within mule deer overall range and severe winter range (Figure 3.6-2 and Figure 3.6-3, Appendix C) (CPW 2019d). Mule deer use of the study area is variable with populations exhibiting seasonal movement as a result of elevational migration in response to snow cover. The majority of the study area is used by mule deer as early spring and winter range, although some may occur in the study area on a year-round basis (BLM 2017).

The study area is located within CPW's Cripple Creek DAU D-16 and GMU 58 for mule deer (Figure 3.6-2, Appendix C). Herd management of mule deer in D-16 is conducted like most herds in Colorado (CPW 2007). Post-hunt population estimates for 2018 indicate that the mule deer population in D-16 was approximately 13,400 individuals (CPW 2019b). CPWs current population objective for D-16 is to target a post-season population of 16,000 to 20,000 deer with a post-season composition of 30 to 35 bucks/100 does (CPW 2007).

### Bighorn Sheep

Bighorn sheep utilize the areas in and around the study area on a year-round basis including Bighorn Sheep Canyon, Cactus Mountain, and the Royal Gorge (BLM 2017). The study area is geographically located within bighorn sheep overall range and severe winter range, which support seasonal migration of bighorn sheep (Figure 3.6-4 and Figure 3.6-5, Appendix C). Herds in Colorado typically migrate between higher elevation summer ranges and lower elevation winter ranges. Severe winter range is defined as part of the winter range where 90 percent of the individual animals are located when the annual snowpack is at its maximum and/or temperatures are at a minimum in the two worst winters out of ten (BLM 2017). CPW has been collecting GPS collaring data on 15 individual bighorn sheep in the study area for several years. The collaring data collected through the study supports CPW's Species Activity Map (SAM) data, which indicates that the local population tends to use habitat in the study area predominantly during winter and early spring (CPW 2019d). Bighorn sheep in the study area generally migrate to higher elevations along the Arkansas River or to the Royal Gorge in March and April.

Bighorns are adapted to a wide variety of habitats. Preferred habitat is provided in areas dominated by rock cover, grass, and shrubs with very steep rugged escape terrain in areas with good visibility (George et al. 2009). In general, bighorn sheep populations in Colorado are not evidently limited by availability of suitable habitat. Winter habitat is more likely to be limiting for bighorn sheep in Colorado. During winters, bighorns often are forced to concentrate on windswept ridges or move to lower elevations where human impacts on habitat are more prominent. CPW considers bighorn sheep susceptibility to domestic livestock diseases the primary factor limiting Rocky Mountain bighorn sheep populations in Colorado (George et al. 2009).

The mineral Sale Area is located within the bighorn sheep Arkansas River GMU S07 and DAU 09 (Figure 3.6-4, Appendix C). Two ram hunting licenses are issued per year in this game management unit, with hunter success being close to 100 percent in most years (CPW 2019c) Levels of hunting activity within the study area are unknown, but are likely to be minimal due to the limited public access and difficult terrain. Rams have been harvested several miles upriver, but none have been confirmed within the Sale Area (CPW 2019c).

Post-hunt population estimates over the past several years for GMU S07 show that the population has remained close to 80 individuals (CPW 2019c). No herd management plan has been completed for DAU 09; however, CPW's bighorn sheep management plans and goals include maintaining or increasing the size of existing herds and populations, with emphasis given to the larger herd complexes (DAUs), or core populations, that represent groups of interconnected herds within a mountain range. Forays (long-distance periodic movements among populations) by bighorn sheep maintain connectivity between populations (or between herds).

Rocky Mountain bighorn sheep are a BLM Colorado designated sensitive species (BLM 2015). In accordance with BLM Manual 6840 – Special Status Species (BLM 2008b), the BLM would take conservation actions to improve the status of such species. Secretarial Order 3362 – Improving Habitat Quality in Western Big-Game Winter Range and Migration Corridors supports the long-term sustainability of Rocky Mountain bighorn sheep populations in Colorado.

### 3.6.1.3. Migratory Birds/Raptors

Nongame birds encompass a variety of passerine and raptor species including migratory bird species that are protected under the Migratory Bird Treaty Act (MBTA) (16 U.S. Code [U.S.C.] 703-711) and Executive Order 13186 (66 FR 3853). Migratory bird species protected by the MBTA are listed in 50 CFR 10.13, and the list of protected species is reviewed and updated regularly. Pursuant to Executive Order 13186, a Memorandum of Understanding (MOU) between the BLM and USFWS outlines a collaborative approach to promote the conservation of migratory bird populations. Additionally, bald and golden eagles are also protected under the Bald and Golden Eagle Protection Act (16 U.S.C.) 668 *et seq.*), which prohibits take and disturbance of individuals and nests. Any actions affecting bald and golden eagle may require development of an eagle conservation plan.

Pinyon-juniper woodlands support the largest number of nesting bird species found in any upland vegetation type in the West (Marcus et al. 2011). In addition to nesting birds, it is likely that birds such as passerines and raptors may migrate through the study area. Although limited in extent, wetland, grassland, and wooded areas throughout the study area may provide important stopover habitat for migrants or individuals during pre- and post-breeding movements.

The study area is located in the Southern Rockies/Colorado Plateau Bird Conservation Region (BCR 16) (Figure 3.6-7 Appendix C). An inventory of migratory and resident bird species potentially occurring within the mineral Sale Area was assembled from several sources including

U.S. Fish and Wildlife Service Birds of Conservation Concern – 2008 List for BCR 16-Southern Rockies/Colorado Plateau. These species are associated with pinon-juniper and mountain shrub habitats, and are species that have declining populations and should be protected from habitat alterations. Table J-1 in Appendix J identifies the eight migratory bird species identified.

Raptor use of the study area is limited primarily to species associated with shrubland and pinon/juniper habitats in the foothills and lower mountain elevations. No raptors were observed during field surveys of the study area. Raptor species that potentially occur as residents or migrants within the study area include eagles (golden eagles), hawks (e.g., red-tailed hawk) falcons (e.g., prairie falcon, American kestrel), northern harrier, and turkey vulture (Cedar Creek 1997). Suitable nesting habitat is present on or near the study area for most of these species, but no nest sites or evidence of nesting activity of any raptor species were located during field surveys (ICF 2019). Cliff sites are numerous within the study area, but there was no evidence of raptor nesting activity on any cliff face within the study area (ICF 2019). Mature cottonwoods exist outside the study area along Tallahassee Creek, and could provide suitable nest sites for red-tailed hawk, golden eagle, and great horned owl. Sensitive bird species are discussed further in Section 3.6.1.4, *Special Status Species.*

### 3.6.1.4. Special Status Species

Special status species are those species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are federally listed species that are protected under the Endangered Species Act (ESA), and species designated as sensitive by the BLM. In addition, there is a Colorado State protected species list (Colorado Revised Statues, Title 33 Article 1-101) that the BLM has incorporated, in part, into its sensitive species list.

In accordance with the ESA, as amended, the lead agency (BLM) in coordination with the USFWS must ensure that any action that they authorize, fund, or carry out would not adversely affect a federally listed threatened or endangered species. In addition, as stated in Special Status Species Management Policy 6840 (6840 Policy) (Rel. 6-125), it also is BLM policy “to conserve and/or recover ESA-listed species and the ecosystems on which they depend so that ESA provisions are no longer needed for these species, and to initiate proactive conservation measures that reduce or eliminate threats to BLM sensitive species to minimize the likelihood of and need for listing of these species under the ESA.”

#### Federally Listed Species

A species consultation list identifying federally listed species potentially occurring in the Sale Area was provided by USFWS through their *Information for Planning and Consultation* (IPaC) online tool. No identified critical habitat and no known occurrences of ESA plant or wildlife species have been observed or have the potential to occur in the study area (USFWS 2019b). In addition, no federal proposed or candidate species are likely to be present within the study area

(Table J-2, Appendix J). However, the study area is located within the range of the Mexican spotted owl, a federally listed threatened species.

**BLM Special Status Species**

A total of 38 special status wildlife species were identified as potentially occurring within the study area (BLM 2019a). These species, their associated habitats, and their potential for occurrence within the study area are summarized in Table J-3. Occurrence potential for each species within the study area and CESA was evaluated for each species based on their habitat requirements and/or known distribution. Fifteen (15) special status wildlife species were identified as having potential to occur within the study area based on habitat requirements and known range distributions.

### 3.6.1.5. Aquatic Communities

Riparian habitat is minimal within the study area and is limited primarily to areas adjacent to Currant Creek. Riparian areas in the study area are dominated by plains cottonwoods (*Populus deltoides*), narrowleaf cottonwood (*Populus angustifolia*), thinleaf alder (*Alnus tenuifolia*), and peachleaf willow (*Salix amygdaloides*) (ICF 2019). Currant Creek is located outside the proposed surface disturbance area, therefore no direct effects to riparian communities are anticipated. Due to insufficient water flow in ephemeral waterbodies within the study area, it is unlikely that wetlands or riparian habitats within the study area support fish species. These areas may support amphibian species. A Stormwater Management Plan (SMP) and Spill Prevention, Control, and Countermeasures (SPCC) Plan would be required for compliance under additional permitting authorities as described in Section 1.5, *Permits and Approvals*; therefore, impacts to aquatic biological resources are not anticipated.

## 3.6.2. Environmental Effects

Terrestrial resource related issues were determined through consultation with CPW (CPW 2019g) and USFWS (USFWS 2019b). No direct or indirect effects to aquatic biological resources are anticipated. The primary issues related to terrestrial wildlife include loss or alteration of native habitats; increased habitat fragmentation; individual and population displacement; and direct mortality or injury of wildlife.

The potential effects of the proposed mineral sale on terrestrial wildlife resources can be classified as short-term (temporary) and long-term in duration. Short-term effects result from habitat disturbance and removal due to construction and from activities associated with quarry operation and occur during the active life of the quarry and until *reclamation* is successfully completed. Short term effects would cease upon quarry closure and completion of successful reclamation. Long-term effects include permanent changes to habitats and the wildlife and aquatic populations that depend on those habitats, regardless of reclamation success.

### 3.6.2.1. Direct and Indirect Effects from Alternative A

**Issue 1: How would the proposed Parkdale Quarry expansion affect the availability and quality of habitat for bighorn sheep and other big game species?**

Under Alternative A, mining would be performed in five phases progressing from west and northwest to southeast (Figure 2.2-2). Habitat losses associated with Alternative A include a total disturbance of 674 acres of bighorn sheep severe winter range and 705 acres of mule deer severe winter range over the life of the quarry (approximately 100 years). Habitat losses would occur in phases, as each phase of mining is implemented, and would be sustained over an approximately 20 to 30-year period as bare bedrock would remain until a mining pit is no longer needed and reclamation is initiated (Table 3.17**)**. Disturbance associated with Alternative A would be reclaimed, as presented in Section 2.3.7. Proposed reclamation activities would aim to replace pinyon-jumpier habitat with plant communities that provide greater winter forage for bighorn sheep and mule deer.

Bighorn sheep and mule deer would avoid a much larger footprint during implementation of Alternative A. Noise and human presence associated with rock and gravel extraction would likely result in additional habitat losses due to displacement of big game species away from operation activities. All processing activities would continue to occur at the existing Parkdale Quarry, so no additional disturbance is anticipated in association with processing facilities.

Project related fencing installed around active mining and reclamation areas would exclude big game species from accessing areas of suitable habitat immediately adjacent to mine operations, although big game are likely to avoid these areas due to human presence and noise. All fencing located within the proposed Sale Area would be wildlife friendly and consist of three-strand fencing with smooth wire and steel posts. Big game could be adversely affected by colliding with or becoming entangled in project fencing, although individuals are anticipated to avoid fenced areas where mining operations are occurring.

Big game may experience higher levels of mortality due to the construction of a new haul road under Alternative A and associated increased vehicular traffic during construction, expansion, and development. Vehicular traffic collisions may injure or kill individual big game species, and local populations may experience higher levels of mortality due to increased number of roads and use of existing roads in the immediate vicinity of the study area.

Adverse effects to the local mule deer and bighorn sheep populations would be expected to be relatively minor since habitat disturbance would occur in phases, suitable habitat is available in the areas surrounding the study area, and no parturition (lambing) areas would be affected. As described in Section 2.3.7, and the Reclamation Plan in Appendix D, Martin Marietta would use a concurrent reclamation technique to minimize the amount of habitat disturbance during active mining. Habitat losses resulting from displacement may be minimized over time as mule deer and bighorn sheep become acclimated to increased operational activities. Mule deer and bighorn sheep have demonstrated the ability to adapt to mining operations as long as they do not associate harassment or hunting with the activity (Jansen et al 2007; MacCallum 1988; MacCallum 1991).

**Table 3.17. Disturbance to Bighorn Sheep and Mule Deer Severe Winter Range Associated with Alternative A**

| Mineral Sale Area | Total Bighorn Sheep Range Disturbance (acres) | Total Mule Deer Range Disturbance (acres) |
|---|---|---|
| Phase 1 – West Pit | 81 | 81 |
| Phase 2 – West Central Pit | 168 | 168 |
| Phase 3 – Central Pit | 206 | 237 |
| Phase 4 – East Central Pit | 112 | 112 |
| Phase 5 – East Pit | 107 | 107 |
| **Total** | **674** | **705** |

### *Potential Protective/Mitigation Measures:*

The Alternative A is proposed in bighorn sheep and mule deer severe winter range. The 1996 Royal Gorge Resource Area Resource Management Plan states that within the Arkansas River Ecoregion, big game critical winter habitat within the Sale Area would be seasonally limited to mineral operations from December 1 to April 30. Colorado Parks and Wildlife has since revised the seasonal restriction dates for bighorn sheep winter range to November 1 to April 15 and for mule deer winter range to December 1 to April 15. Alternative A does not serve the purpose of improving the site for wintering big game; therefore, a timing limitation from November 1 to April 15 would be enacted to eliminate disturbance to bighorn sheep and mule deer during this critical period to avoid an adverse impact. This measure would be applied to the initial year of mine expansion activity, as interpreted by CPW in consultation with the BLM biologist. The timing limitation would not be applied in subsequent years as bighorn sheep are anticipated to acclimate to disturbance in areas of active mining.

*Effectiveness:*

Implementation of this measure would avoid and minimize adverse effects to bighorn sheep during periods of severe winter conditions when snow depths restrict access to forage and other habitat components. Limitation of mining activity during this period would result in a reduction of potential disturbance and displacement of bighorn sheep during this sensitive period.

### Issue 2: How would the proposed Parkdale Quarry expansion affect the availability and quality of habitat and nesting sites for migratory bird species?

As described in Section 3.6.1.3, a variety of migratory bird species (e.g., raptors and songbirds) have been identified as potentially occurring within the study area. Potential direct effects to bird species would include the short-term reduction of 705 acres of potentially suitable breeding, roosting, and foraging habitat, including 370 acres of pinyon-juniper habitat, and 334 acres of shrub/scrub habitat. Raptor mortalities could increase under Alternative A due to vehicular collisions similar to big game species. Alternative A would result in decreased quality of habitat for raptor prey species due to changes in vegetation community composition and/or an increase in invasive species during mine development, which would result in reduced prey availability.

Effects to other migratory bird species would be similar to those described for raptors, excluding the effects on prey availability and predation, which are not applicable to other birds that do not prey on small mammals. Overall effects to migratory birds and raptors are expected to have minimal effect on local bird populations based on the amount of suitable breeding and foraging habitat in the area surrounding the study area, which would not be affected by Alternative A.

### *Protective/Mitigation Measures*

To be in compliance with the Migratory Bird Treaty Act and the Memorandum of Understanding between the BLM and the USFWS required by Executive Order 13186, the BLM must avoid actions, where possible, that result in a "take" of migratory birds. Pursuant to BLM Instruction Memorandum 2008-050, to reduce impacts to Birds of Conservation Concern, no habitat disturbance (removal of vegetation such as timber, brush, or grass) is allowed during the periods of May 15 to July 15, the breeding and brood rearing season for most Colorado migratory birds. The provision would not apply to completion activities in disturbed areas that were initiated prior to May 15 and continue into the 60-day period.

An exception to this timing limitation would be granted if nesting surveys conducted no more than one week prior to vegetation-disturbing activities indicate no nesting within 30 meters (100 feet) of the area to be disturbed. Surveys shall be conducted by a qualified breeding bird surveyor between sunrise and 10:00 a.m. under favorable conditions.

### Issue 3: How would the proposed Parkdale Quarry expansion affect the availability and quality of habitat for special status wildlife species?

Special status species are identified in Table J-3 (Appendix J). Effects to special status wildlife species would be similar to those described above for big game and migratory bird species. Direct effects to special status species would include the short-term reduction of 370 acres of pinyon-juniper habitat, and 334 acres of shrub/scrub habitat. Effects would include displacement from the disturbed areas and increased habitat fragmentation until vegetation is re-established. In most instances, suitable habitat adjacent to disturbed areas would be available for use by these species; however, displacement would increase competition and could result in some local reductions in special status wildlife populations if adjacent habitats have a higher density of species.

Direct mortality and injury due to vehicle collisions would be similar for special status species as for other wildlife species. Indirect effects on special status mammal species would also be similar to those described for big game, with the exception of effects to seasonal habitats and migratory corridors, which are not delineated for special status species in the study area. Habitat fragmentation would have a greater impact on special status species where roads and other disturbed areas lacking vegetation would present a barrier to movement due to lack of cover and vulnerability to predation. Potential effects to special status species from quarry development are expected to be low, due to the low probability of their occurrence in the proposed Sale Area.

### Bats

Two bat species (Townsend's big-eared bat and fringed myotis) have the potential to occur in the Sale Area. Implementation of Alternative A could result in direct and indirect impacts to these local bat species and their habitat, especially when disturbance occurs in riparian, shrubland, woodland, grassland and meadow foraging habitats. Direct impacts would include loss of foraging, nursery, and hibernacula habitat during the life of the quarry, and mortalities due to vehicular traffic collisions.

Indirect impacts associated with Alternative A include increased noise related to mining activities, human presence and artificial lighting used for nighttime operations in the existing processing area only. Some bat species, like Townsend's big-eared bats, are especially susceptible to disturbance, and may abandon nursery and hibernaculum, leading to increased mortality (CNHP 2013). Arousal in winter could deplete vital energy stores and prevent arousal in spring. Project-related noise from construction, vehicle traffic, and increased human activity could adversely affect these species. The use of artificial lighting during night-time operations could adversely impact foraging bats.

Potential roost sites for these bat species include crevices on cliff faces, mines, caves, trees, and buildings. Existing crevices on cliff faces, rock outcrops and small cavities are numerous in the Sale Area and may provide roosting habitat, and would be impacted under Alternative A. The increase disturbance and noise near these roosting habitats may also cause displacement of aversion to use of the habitats. Overall population-level effects to sensitive bat species are expected to be minimal based on the amount of suitable roosting and foraging habitat in the area surrounding the study area, which would not be affected by Alternative A.

#### *Protective/Mitigation Measures*

None are identified.

### Birds

#### *Golden Eagle*

Although no golden eagles or nest sites were identified within the study area during baseline surveys, individuals could occur while opportunistically foraging for roadkill or passing through the study area. Direct impacts would include the short-term reduction of 705 acres of potential foraging and breeding habitat and direct mortality due to vehicular collisions. Indirect impacts are associated with increased mine-related noise and human presence that would increase under Alternative A.

Additional indirect impacts to golden eagles would be similar to those discussed for migratory birds above. Potential impacts to this species as a result of Alternative A are considered low due to the lack of active nest sites or individuals within the study area, and low potential for impacts to the prey base in the study area.

### Burrowing Owl

Although no burrowing owl nest locations or preferred foraging areas containing prairie dog colonies were observed during baseline studies, this species may occur within the study area. Direct impacts to western burrowing owl would include short-term reduction of 705 acres of potential breeding and foraging habitat. In addition, burrowing owls could be particularly affected by roads development, as this species only nests in burrows on the ground; consequently, roads could result in destruction of burrowing habitat, and burrowing owls may be more susceptible to collisions with vehicles.

Indirect impacts associated with mine-related noise and human presence currently occur at the site and would increase under Alternative A. Burrowing owls maybe also be indirectly affected by any adverse impacts on prairie dog towns because burrowing owls often use abandoned prairie dog burrows as nest sites. However, reclamation of disturbed areas, which would provide more open ground and herbaceous cover preferred by prairie dogs, could result in expansion of prairie dog burrows and subsequently increase the abundance of nesting sites for burrowing owls. Burrowing owls also prefer open ground for hunting and for nesting sites. Increased prairie dogs in the Project Area would also increase prey abundance for larger raptor species such as golden eagles, bald eagles, and ferruginous hawks. Potential impacts to this species as a result of the Alternative A are considered low due the overall availability of suitable habitat in the study area, and the lack of nesting owls or individuals observed during surveys.

### Ferruginous Hawk

Although no ferruginous hawk nests were identified within the Sale Area and this species was not observed during surveys, individuals could occur while foraging or passing through the Sale Area. Direct impacts would include the short-term reduction of 370 acres of pinyon-juniper and 334 acres of shrub/scrub foraging habitat until final reclamation is completed and vegetation re-established and a long-term reduction of 194 acres. Indirect impacts associated with Alternative A include increased mine-related noise and human presence.

Additional indirect impacts to ferruginous hawks associated with Alternative A would be similar to those discussed for migratory birds above. Potential impacts to this species as a result of the proposed mineral sale are considered low due to the lack of active nest sites within the study area, the current level of activity at the mine site, and low potential for impacts to the prey base in the study area.

These direct adverse impacts to sensitive raptors and migratory bird species associated with the construction and operation of the proposed project would be minimized due to the implementation of Applicant Committed Environmental Protection Measures presented in Table 2.2.

#### *Protective/Mitigation Measures*

None are identified.

### Amphibians

#### *Plain's Leopard Frog*

Plain's leopard frog has not been documented within the study area, but suitable habitat exists. Implementation of Alternative A could result in direct and indirect impacts to the Plain's leopard frogs and their habitat, especially when disturbance occurs in wetland and riparian habitats. Direct impacts would include loss of foraging, breeding, and over-wintering habitat during the life of the quarry, and mortalities due to vehicular traffic collisions.

Indirect effects resulting from implementation of Alternative A include increased habitat fragmentation where roads and other disturbed areas lacking vegetation would present a barrier to movement due to lack of cover and vulnerability to predation and increased erosion and sedimentation due to surface disturbance. Potential effects to the Plain's leopard frog from quarry development are expected to be low, due to the low probability of their occurrence in the proposed Sale Area, and the lack of suitable aquatic features.

#### *Protective/Mitigation Measures*

None are identified.

### Plants

There are six sensitive plant species (Rydberg's golden columbine, Brandegee's buckwheat, gold blazingstar, Royal Gorge blazingstar, rock-loving noeparrva, and Degener's beardstonque) that have the potential to occur in the study area based on the availability of suitable habitat. Most of these species prefer open areas in pinyon-juniper and shrubland communities, or barren soils on rock outcrops or hillsides. Under Alternative A, the majority of surface disturbance would occur in shrubland and pinyon juniper habitat, and in upland areas that were previously undisturbed. Impacts to BLM sensitive plant species could include direct mortality as a result of surface disturbance, habitat fragmentation associated with habitat loss, and the partial or complete destruction of an individual plant or cluster of plants' seed banks where surface-disturbing activities occur. Indirect impacts include a change in vegetation composition and diversity, expansion of invasive species and noxious weeds, and potential for increased soil erosion. Soil erosion could result in less soil to support special status plant communities.

Reclamation activities would aim to revegetate the study area predominantly with grassland species, resulting in a loss of sagebrush-steppe and shrubland vegetation communities with which most of these plant species are associated. This could result in long term habitat loss from the conversion of pinyon juniper and shrub-dominated cover types to predominantly grass and forb cover types. Activities associated with Alternative A could have a direct adverse impact on special status plant species populations if mining activities could not avoid established plant communities. Proposed mitigation measures could reduce potential impacts on special status plant species.

***Protective/Mitigation Measures***

Pre-construction surveys would be conducted within the proposed area of disturbance for all special status plant species that have potential habitat, as determined by the BLM, in the Sale Area. While the BLM may direct Martin Marietta to avoid areas containing special status plant species populations, lease stipulations in the Sale Area do not prohibit development (i.e., No Surface Occupancy [NSO] stipulation) that could have a direct physical impact on these populations.

Interim and final reclamation should aim to restore areas of potential habitat for sensitive plant species identified during pre-construction surveys.

#### 3.6.2.2. Direct and Indirect Effects from Alternative B

Under Alternative B, the proposed mineral Sale Area would not be developed, and direct and indirect effects to wildlife resources would not occur beyond those effects resulting from previously authorized disturbance. Under this alternative, 705 acres of potential wildlife habitat would not be disturbed or lost, as described under Alternative A. Additional habitat fragmentation and animal displacement would not occur, limiting the effects to wildlife resources to existing conditions.

#### 3.6.2.3. Direct and Indirect Effects from Alternative C

In response to stakeholder concerns regarding potential impacts under Alternative A to bighorn sheep and their habitat located within the proposed Arkansas River Canyonlands ACEC to the west of the Sale Area, Martin Marietta provided an Alternative Materials Sale Area (Alternative C) boundary to the BLM for evaluation (Martin Marietta 2019a). Alternative C would include approximately 633 acres of surface disturbance, and potential effects to game, migratory birds, and special status species under Alternative C would be similar in extent to Alternative A, but would include approximately 65 fewer acres of surface disturbance and would be shifted to the east approximately one half-mile away from the ACEC.

***Protective/Mitigation Measures***

None are identified.

*Residual Effects:* Assuming successful reclamation of all project components, residual impacts to wildlife habitat would include the temporary loss of approximately 698 acres and 633 acres of wildlife habitat under Alternative A and Alternative C, respectively. This loss off wildlife habitat would be incremental over the 100-year life of mine and would persist until final reclamation is complete and successful.

## 3.6.3. Cumulative Effects Analysis

The CESA for special status species encompasses the Tallahassee Creek-Currant Creek watershed and Royal Gorge-Arkansas River watershed (Hydrologic Unit Code, HUC 10: 1102000111), the CESA for migratory birds is the Arkansas Headwaters Sub-basin (HUC 8: 11020001) (Figure 3.6-7), the CESA for bighorn sheep comprises the Arkansas Valley DAU S09 (GMUs S47, S68, S07, S49, and S79) and the Shelf Road DAU (GMU S60) (Figure 3.6-6, Appendix C) and the CESA for mule deer comprises the Cripple Creek DAU D-16 (GMUs 49, 57, 58, and 581) and the Wet Mountain DAU D-34 (GMUs 86, 69, 84, 861, 691) (Figure 3.6-2). The CESAs include contiguous areas that provide important seasonal habitat for general wildlife species.

The past, present, and RFFAs are discussed in Section 3.2, *Past, Present, and Reasonably Foreseeable Future Actions*. RFFAs from mining and exploration activities are identified in Section 3.2, *Past, Present, and Reasonably Foreseeable Future Actions*.

Past, present, and RFFAs in the wildlife CESAs have resulted, or would result in the direct disturbance of habitat primarily related to urbanization and population growth infill, roads and highways, mineral development, transmission lines, and grazing and agriculture activities. Development of reasonably foreseeable mining and infrastructure projects needed for urban development is anticipated across the CESAs, especially in and around existing population centers such as Salida, Cañon City, Brookside, and Florence. Wildfire has also impacted wildlife habitat near the Sale Area. In the last two decades wildfires have burned approximately 8,000 acres. The regional area is an arid climate and if the current trend in climate change continues wildfire frequency may increase and have an increasing impact on wildlife habitat.

### 3.6.3.1. Alternative A

Cumulative effects to wildlife resources would be predominantly related to habitat loss, habitat fragmentation and wildlife displacement associated with Alternative A as described in Section 3.6.2, *Environmental Effects*. These effects would be present throughout the life of the mine until final reclamation is complete. Other direct effects to big game species include mortalities or injury resulting from vehicle collisions as well as indirect effects such as avoidance, restriction of movement (due to new facilities or roads), displacement of animals from the RFFAs during all seasons, and increased potential for poaching/hunting.

The type and nature of cumulative effects to migratory bird species would be primarily related to the direct and indirect effects of Alternative A described in Section 3.6.2, *Environmental Effects*, and would include direct mortality through vehicular traffic collisions due to increased access and activity in the area. Indirect effects include habitat loss, degradation, and habitat fragmentation, as well as disturbance and displacement from areas with human activities.

Potential cumulative effects to special-status species also would be similar to those described in Section 3.6.2, *Environmental Effects*, and primarily related to Alternative A. Special status species including small mammals, migratory birds, reptiles, and amphibians that occur in the CESA would continue to occupy their respective ranges and breed successfully; however, population numbers may decrease relative to the amount of cumulative habitat loss and disturbance from incremental development. Effects would most likely occur where the RFFAs and Alternative A overland the special status species CESA.

### 3.6.3.2. Alternative B

Cumulative effects resulting from past, present, and RFFAs to wildlife resources for Alternative B would generally be the same as those described for Alternative A. However, there would be 705 acres less of surface disturbance and associated habitat fragmentation within the CESA under Alternative B. Effects to the existing bighorn sheep and mule deer severe winter ranges, migratory birds, and special status species would be limited to those resulting from previously authorized actions for the existing Parkdale Quarry.

### 3.6.3.3. Alternative C

Cumulative effects resulting from past, present, and RFFAs to wildlife resources for Alternative C would generally be the same as those described for Alternative A. However, there would be 65 acres less of surface disturbance and associated habitat fragmentation within the CESA under Alternative C. These effects would be present throughout the life of the mine until final reclamation is complete.

# 3.7. LANDS WITH WILDERNESS CHARACTERISTICS

**Issue 1: How would the proposed Parkdale Quarry Expansion affect the currently inventoried area identified as having wilderness characteristics?**

## 3.7.1. Affected Environment

BLM policy in Section 201 of FLPMA requires the BLM to maintain, on a continuing basis, an inventory of all public lands and their resources and other values, including wilderness characteristics. The RGFO conducted an inventory of lands with wilderness characteristics in 2015 in accordance with BLM Manual 6310, *Conducting Wilderness Characteristics Inventory* *on BLM Lands*, which is the policy that provides guidance on how to conduct an inventory. The RGFO 2015 inventory identified over 190,000 acres of lands having wilderness characteristics and included the Echo Canyon lands with wilderness characteristics unit consisting of approximately 31,600 acres. The Echo Canyon unit is located within Bighorn Sheep Canyon, approximately 11 miles west of Cañon City. The unit contains the proposed Sale Area, which lies on the eastern edge of the unit (Figure 3.7-1). The rugged terrain of the area, overall size, lack of public access, and opportunities for solitude and primitive and unconfined recreation all contribute to the area's wilderness characteristics. Echo Canyon in general has many mechanically constructed and maintained routes within the area. Evidence of past human activity such as mining tailing piles and prospecting pits, a water catchment, mechanical vegetation treatments, and wildlife exclosures are located within the unit. Motorized access into the area is for administrative access only, limiting use and contributing to the wilderness characteristics of the area. The existing quarry is located to the south of the proposed expansion area on 513 acres of private land owned by Martin Marietta.

## 3.7.2. Environmental Effects

### 3.7.2.1. Direct and Indirect Effects from Alternative A

**Issue 1: The Parkdale Quarry Expansion Alternative A would affect the currently inventoried Echo Canyon area identified as having wilderness characteristics.**

If Alternative A were to be selected by the BLM, development of the Sale Area in the eastern portion of proposed Echo Canyon unit would incrementally eliminate 1,458 acres of public lands from possessing wilderness characteristics and likely an additional isolated 536 acres to the east of the Sales Area for a total of 1,996 acres. This represents approximately six percent of the Echo Canyon unit identified as lands with wilderness characteristics. The remaining acreage of the Echo Canyon area would not be affected by Alternative A and the inventoried wilderness characteristics would still apply. The Sale Area likely would not meet LWC criteria even after reclamation. The BLM would re-inventory the Sale Area after reclamation to determine if it meets the criteria for lands with wilderness characteristics.

***Protective/Mitigation Measures***

No protective or mitigation measures would avoid or minimize the reduced acreage of wilderness characteristics that apply to the Echo Canyon area.

### 3.7.2.2. Direct and Indirect Effects from Alternative B

**Issue 1: None.**

Under Alternative B, the BLM would deny Martin Marietta's mineral materials application. There would be no expansion of the Parkdale Quarry onto BLM-administered lands and the Echo Canyon lands with wilderness characteristics unit. Martin Marietta would continue to mine privately owned lands at the Parkdale Quarry for the next 15 to 30 years and conduct reclamation and closure of the mine according to their existing, authorized permits.

***Protective/Mitigation Measures***

No protective or mitigation measures would be required because there would be no impacts to the Echo Canyon lands with wilderness characteristics unit.

### 3.7.2.3. Direct and Indirect Effects from Alternative C

**Issue 1: The Parkdale Quarry Expansion Alternative C would affect the currently inventoried Echo Canyon area identified as having wilderness characteristics.**

Alternative C proposes to shift the Sale Area to the east approximately one half-mile. The Alternative C Sale Area boundary includes a total of approximately 893 acres. If Alternative C were to be selected by the BLM, development in the eastern portion of the proposed Echo Canyon lands with wilderness characteristics unit would eliminate 893 acres from possessing wilderness characteristic and likely an additional isolated 340 acres to the east of the Sales Area for a total of 1,233 acres. This represents approximately four percent of the total Echo Canyon acreage. The remaining acreage of the Echo Canyon unit would not be affected, and the inventoried wilderness characteristics would still apply. Once the area has been successfully reclaimed it is likely that the Sale Area would not meet LWC criteria but the area would be re-inventoried by the BLM at that time to determine if it meets the criteria for lands with wilderness characteristic

***Protective/Mitigation Measures***

No protective or mitigation measures would avoid or minimize the reduced acreage of wilderness characteristics that apply to the Echo Canyon area.

## 3.7.3. Cumulative Effects Analysis

**Issue 1: The Parkdale Quarry Expansion would affect the currently inventoried Echo Canyon area identified as having wilderness characteristics.**

The CESA for lands with wilderness characteristics is the Echo Canyon area in its entirety, as shown in Appendix C, Figures 3.7-1 and 3.7-2. Past and present activities in the CESA have resulted in impacts to the naturalness of the Echo Canyon area. Little disturbance has occurred within the CESA, however, mechanically constructed and maintained routes within the area, mining tailing piles and prospecting pits, water development improvements, mechanical vegetation treatments, and wildlife exclosures are located within the Echo Canyon area and have an impact on the overall naturalness of the area. RFFAs in and adjacent to the CESA would include an overall increase in human presence proportional to the anticipated population growth, new mining operations to support infrastructure construction necessary to accommodate the anticipated population increase, and potential changes to frequency and intensity of wildland fire due to current climate change trends.

### 3.7.3.1. Alternative A

Alternative A would contribute to cumulative impacts to the wilderness characteristics of the Echo Canyon area by creating 698 acres of surface disturbance that would likely result in the elimination of 1,298 acres that would otherwise be included in the potential designation as lands with wilderness characteristics.

### 3.7.3.2. Alternative B

Under Alternative B, the existing quarry would not be expanded and would not contribute to cumulative impacts to the wilderness characteristics of the Echo Canyon area.

### 3.7.3.3. Alternative C

Alternative C would contribute to cumulative impacts to the wilderness characteristics of the Echo Canyon area by creating 633 acres of surface disturbance that would likely result in the elimination of 1,233 acres from the inventory of lands with wilderness characteristics.

# 3.8. VISUAL RESOURCES

**Issue 1: What is the extent of impact upon sensitive visual receptors resulting from the change in landforms during operations and post-mining?**

## 3.8.1. Affected Environment

The study area for visual resources encompasses the viewshed specific to Alternative A and Alternative C and the CESA includes an area within 15 miles of the Sale Area. This geographic region was selected as the CESA because beyond 15 miles from the proposed Sale Area, the proposed project facilities and excavation site would either not be visible or would be considered as a minor element in the visual landscape.

Scenic quality is the measure of the visual appeal of a unit of land. Section 102(a) of the FLPMA (1976), states that "…the public lands are to be managed in a manner that would protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values." Section 103(c) identifies "scenic values" as one of the resources for which public land should be managed. Section 201(a) states that "the Secretary shall prepare and maintain on a continuing basis an inventory of all public lands and their resources and other values (including scenic values)…". Furthermore, Section 101(b) of the National Environmental Policy Act requires that measures be taken to ensure that aesthetically pleasing surroundings be retained for all Americans.

A visual resource inventory (VRI) was conducted for the Sale Area in 2015. The inventory revealed that visual resources along the Arkansas River corridor in Bighorn Sheep Canyon are dominated by the river as well as rocky outcrops and steep valley walls, with a variety of vegetation and colors. The river canyon has high recreation visitation that is dependent upon intact landscapes and natural scenery. The public land in the canyon is highly visible from Highway 50, a major travel corridor for residents and visitors. The inventory found that scenic quality is important for rural residents' quality of life. Sensitivity to change among the local residents is considered high. The inventory also identified the presence of contrasts with the natural environment such as ranches, homes, recreation facilities, power lines, and active mines. Despite the non-natural features the overall landscape was still found to have a VRI Class II.

The VRI was done at a coarse office wide scale, and described below. When looking at the specific Sale Area, the existing quarry beyond the railroad line is evident with its conical shaped stockpiles, earthen berm, and horizontal quarry bench cuts. Rail cars are frequently parked on the tracks. The vegetation changes from sparse in the foreground to uniform pinyon and juniper woodlands in the background. Structures in the mine are visible from the road. Besides the river corridor, which is immediately adjacent to the Highway, these elements tend to dominate the view in this area.

Visual Resource Management (VRM) classes along with the corresponding VRM Objectives were established in the Royal Gorge Field Office (RGFO) in 1996 with the approval of the Royal Gorge Resource Area Resource Management Plan (RMP). Visual Resource Management objectives corresponding to the various management classes provide standards for analyzing and evaluating proposed projects. Projects are evaluated using the Contrast Rating System to determine if it meets VRM objectives established by the RMP.

The VRM class established in the 1996 Royal Gorge Resource Area RMP (BLM 1996) for the proposed Sale Area is Class II. The objective for Class II is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer.

Five key observation points (KOPs) have been identified in the visual resources study area. Factors considered in selecting the KOPs include angle of observation, number of viewers, length of time the proposed Sale Area is in view, relative Sale Area size, season of use, and light conditions. These KOPs were used for conducting the characteristic landscape, impacts, and VRM compliance analysis. KOP locations are shown in Figure 3.8-1, and described below:

- KOP 1 was chosen as a vantage point for vehicles traveling west on Highway 50, while being far enough away from KOP 4 to provide a different viewpoint.
- KOP 2 was chosen for vehicles traveling east on Highway 50. Its location on the curve of Highway 50 would provide a vantage point to the Sale Area for those traveling east.
- KOP 3 was chosen as an in-river vantage point for recreationists traveling down the Arkansas River, a very popular recreational activity in the area.
- KOP 4 was chosen as a vantage point for recreationists gathering at the Arkansas Headwaters Recreation Area, Parkdale site. Visitors here would likely be in that parking area putting kayaks/rafts into the river, pulling kayaks/rafts out of the river, getting gear organized, etc. (CPW 2019f). It is expected that recreationists would be at KOP 4 for a longer time period than the other KOPs, and it provides a clear vantage point of the Sale Area.
- KOP 5 was chosen as the Arkansas Canyonlands ACEC location because it sits high on the hillside, it looks down on the Sale Area so it has an unobstructed view, and it is still within two miles of the Sale Area. However, access to KOP 5 is poor and therefore has few visitors.

Two additional KOPs were selected to analyze visual impacts related to the alternative Sale Area (Alternative C). Because Alternative C would shift the Sale Area to the east, including portions of the eastern slope of Cactus Mountain, travelers along Highway 9 would likely have a vantage point of the mining and reclamation activities that they would not have under Alternative A. Therefore, these two additional KOPs represent vantage points for travelers along Highway 9, and are analyzed under Alternative A (Figure 3.8-1):

- KOP 6 was chosen for vehicles traveling south on Highway 9. The location of this KOP would likely provide commuters a vantage point of the alternate Sale Area, primarily on the western slope of Cactus Mountain.
- KOP 7 was chosen for vehicles traveling north on Highway 9. The location of this KOP would likely provide commuters a vantage point of the alternate Sale Area, primarily on the western slope of Cactus Mountain.

## 3.8.2. Environmental Effects

This section discusses project related impacts to visual resources resulting from Alternative A, Alternative B, and Alternative C. Primary issues related to visual resources include direct and indirect impacts associated with the change in landforms and degradation of views from KOPs in the vicinity of the project. All visual simulations used for the analysis for impacts to visual resources are provided in Appendix H.

Each of the alternatives considered in this EIS were analyzed for its potential to result in impacts on visual resources. Visual impacts were analyzed using the methodology outlined in the BLM Handbook H8431-1, Visual Resource Contrast Rating (BLM 1986b), which analyze the levels of visual contrast created between a project and the existing, characteristic landscape. As noted previously, the management standards and allowable contrasts for the visual rehabilitation area are those of the management Class II objective. The following indicators were considered when analyzing the potential impacts that each alternative would have on visual resources:

- Degree of consistency or conflicts with established BLM VRM class objectives; and
- Change in the scenic quality of the existing characteristic landscape from KOPs due to visibility of components of Alternative A other alternatives to Alternative A.

### 3.8.2.1. Direct and Indirect Effects from Alternative A

**Issue 1: What is the extent of impacts on sensitive visual receptors resulting from the change in landforms during operations and post-mining?**

The visual impacts would be greatest from KOP 5 because the proposed Sale Area would be in the immediate foreground. The strong form and sharp line of the proposed Sale Area would create a contrast compared to the existing landforms. All five mining phases would be visible from KOP 5; however, concurrent reclamation would be implemented as mining progresses, reducing the overall visual impact. The proposed haul road would appear at the base of the proposed Sale Area but would be weakly visible. Once the proposed Sale Area has been reclaimed and the vegetation has established, the shape, contour, and contrast of the area compared to the surrounding natural landforms would be visible from KOP 5, but would unlikely attract attention.

Visual impacts from KOP 2 would also be high. The proposed Sale Area would be in the immediate foreground from KOP 2 for those traveling east on Highway 50. However, impacts would not be visible until approximately Phase 3, because the hillside immediately to the north of KOP 2 would obstruct views to Phases 1 and 2. Visual impacts from KOP 2 would be reduced due to the implementation of concurrent reclamation. It is unlikely that the proposed haul road would be visible from KOP 2. Once the proposed Sale Area has been reclaimed and the vegetation has established, the shape, contour, and contrast of the Sale Area compared to the surrounding natural landforms would be visible from KOP 2, but would unlikely attract attention.

Due to the “mine from behind” approach to the proposed Sale Area, the predominate hillsides between KOP 1 and the proposed Sale Area would block a majority of the views of the proposed Sale Area for those traveling west on Highway 50. Mining Phases 1 and 2 would not be visible for passing motorists, while Mining Phases 3 through 5 would only be slightly noticeable, due to the alterations of the ridgeline from this vantage point. It is unlikely that the proposed haul road would be visible from KOP 1. The changes in the ridgeline of the proposed Sale Area would be noticeable to those familiar with the area; motorists passing through would not be aware of the mining operation taking place on the backside of the ridge.

Visual impacts from KOP 4 would be similar to those of KOP 1. The proposed Sale Area would be in the immediate foreground from KOP 4 for recreationists gathering at the Arkansas Headwaters Recreation Area, Parkdale site. Visitors here are likely to spend some time at this location, whether they are organizing gear and preparing to put their rafts or kayaks into the river, using the restroom facilities, or taking their rafts/kayaks out of the river. Similar to the vantage point from KOP 1, the mining impacts from KOP 4 would not be visible until approximately Phase 3. The hillsides immediately north of KOP 4 would obstruct views to Phases 1 and 2. It is unlikely that the proposed haul road would be visible from KOP 4. Once the proposed Sale Area has been reclaimed and vegetation has established, the shape, contour, and contrast of the Sale Area compared to the surrounding natural landforms would be visible from KOP 4, but would unlikely attract attention.

Visual impacts from KOP 3 would be similar as those from KOP 1 and KOP 4. For those recreating in the Arkansas River, mining and reclamation activities would not be noticeable until Mining Phases 3 through 5. The ridgelines on Cactus Mountain would be altered during Mining Phases 3 through 5, resulting in minor to moderate impacts to visual resources. While the shape, contour, and topography of Cactus Mountain would be altered during the mining and reclamation phases, it is unlikely that these changes would attract attention from recreationists in the Arkansas River at KOP 3.

The proposed Sale Area would be seeded, and vegetation cover would establish during the ongoing reclamation efforts at the Sale Area. Vegetation cover would consist of native species that closely resemble existing undisturbed vegetation of Webster Park and the hillsides surrounding Webster Park, south of the Parkdale Quarry and Arkansas River. The landscape of Webster Park is shortgrass prairie on the lowland areas, bordered by hillside/montane areas on mountain scrubland dominated by sagebrush and mountain mahogany. The reclamation of the proposed Sale Area would result in the replacement of the existing pinion-juniper plant community with grassland and shrub plant communities. Although the restored vegetation is expected to enhance wildlife habitat, it would likely create a visual contrast with the vegetation immediately adjacent to the proposed Sale Area. Accordingly, visual contrast related to the restored vegetation would be permanent and moderate following operation and reclamation, but is unlikely to attract attention.

During and post-reclamation, the topographic transformation of the proposed Sale Area would result in highly noticeable visual impacts due to the topographical transformation of the western slope of Cactus Mountain. Although the reclamation benches, which would be approximately 35 feet high with a width of approximately 30 feet, would be backfilled to an approximate reclamation slope of 1:1 (horizontal to vertical), the shape, form, and contour of the proposed Sale Area would be substantially different than pre-mining conditions.

Overall, visual impacts at the proposed Sale Area during mining operations, post-closure, and reclamation would be noticeable from the KOPs. There would be a change in the shape, contour, contrast, and vegetation cover through all mining phases and reclamation. However, because the mining operations and reclamation activities would be completed in five phases spanning 100 years, and the areas disturbed would be concurrently reclaimed as mining progresses, the overall impacts would be mitigated and decreased. Therefore, the VRM Class II status of the proposed Sale Area would be maintained. Mining and reclamation activities would be visible, but they would not attract the attention of the casual observer.

***Protective/Mitigation Measures***

As described above, concurrent reclamation of mine areas for which mining has been completed would be implemented. This would allow for vegetation to establish where mining has been completed, while mining activities are in progress elsewhere within the proposed Sale Area. Concurrent reclamation would result in reduced impacts to visual resources and visual contrast.

## 3.8.2.2. Direct and Indirect Effects from Alternative B

**Issue 1: What is the extent of impacts on sensitive visual receptors resulting from the change in landforms during operations and post-mining?**

Under Alternative B, the mining expansion and associated activities would not occur. Therefore, new visual contrasts would not be introduced, and visual resources would not change from their current condition.

***Protective/Mitigation Measures***

No protective or mitigation measures would be implemented under Alternative B, other than what is mandated in the existing permits for operating the Parkdale Quarry.

## 3.8.2.3. Direct and Indirect Effects from Alternative C

**Issue 1: What is the extent of impacts on sensitive visual receptors resulting from the change in landforms during operations and post-mining?**

Unlike under Alternative A, the “mine from behind” approach for the alternative Sale Area would only partially conceal mining activities for those traveling west on Highway 50 at KOP 1. Mining activities and reclamation would be readily visible from KOP 1, primarily from the alteration of the ridgeline. Mining Phase 1 would be particularly noticeable from this KOP, as this mining phase would remove a portion of the ridgeline to the west. Mining Phases 5 and 6 would also be noticeable for motorists traveling west on Highway 50. The form and line of the ridges would be altered enough to be noticeable, but may not attract attention from this KOP. Additionally, concurrent reclamation would be implemented as mining progresses, reducing the overall visual impact. The haul road under Alternative C would be slightly noticeable from KOP 1, but would not likely attract attention. Once reclamation is complete, the changes to the ridgeline of the alternative Sale Area would only be noticeable to those familiar with the area; travelers passing through would not be aware of the mining operations that occurred within the alternative Sale Area.

Visual impacts would be high from KOP 5. The alternative Sale Area would be in the immediate foreground for those in the ACEC at this KOP. The strong form and sharp line of the alternative Sale Area would create a contrast compared to the existing landforms, and portions of the ridgeline of Cactus Mountain would be removed. All six mining phases would be visible from KOP 5, however, concurrent reclamation would be implemented as mining progresses, reducing the overall visual impact. The haul road under Alternative C would appear at towards the higher elevations of Cactus Mountain from KOP 5, but would be weakly visible and would not attract attention. Once the alternative Sale Area has been reclaimed, the shape, contour, and contrast of the area compared to the surrounding natural landforms would be noticeable from KOP 5, but would not attract attention.

Similar to the proposed action, visual impacts from KOP 2 would be high. The alternative Sale Area would be in the immediate foreground from KOP 2 for those traveling east on Highway 50. Mining and reclamation activities would be visible for all mining phases, because the alternative configuration of the mining phases would not be hidden by hillsides and would be within view for those traveling east on Highway 50. A portion of the haul road would be slightly visible from KOP 2 and is not expected to attract attention. Concurrent reclamation would be implemented as mining progresses, reducing the overall visual impact. Once the alternative Sale Area has been reclaimed, the shape, contour, and contrast of the Sale Area compared to the surrounding natural landforms would be visible from KOP 2. However, because a majority of those viewing the alternative Sale Area from KOP 2 would be traveling east on Highway 50, the altered topography is not likely to attract attention.

Visual impacts from KOP 4 would be high. The alternative Sale Area would be in the immediate foreground from KOP 4 for recreationists gathering at the Arkansas Headwaters Recreation Area, Parkdale site. Just as under Alternative A, visitors here are likely to spend more time at this location than the other KOPs. The mining impacts from KOP 4 would be visible for all of the mining phases. Portions of the haul road would be visible from KOP 4, and may attract attention from recreationists gathering in this area. Once the alternative Sale Area has been reclaimed, the shape, contour, and contrast of the alternate Sale Area compared to the surrounding natural landforms would be visible from KOP 4.

Visual impacts from KOP 7 would be moderate for those traveling north on Highway 9. Travelers would be able to see mining and reclamation activities on the crest and backside of Cactus Mountain. Mining Phase 1 would create the most noticeable contrast from existing conditions, resulting in highly visible impacts. The remaining mining phases would result in minor impacts to visual resources, as most of the mining activities and impacts would not be visible to motorists traveling north on Highway 9. The haul road under Alternative C would not be visible from KOP 7. Once the alternative Sale Area has been reclaimed, the shape, contour, and contrast of the Sale Area compared to the surrounding natural landforms would be visible from KOP 7, but would not attract attention.

Visual impacts from KOP 3 would be minor to moderate for those recreating on the Arkansas River. Recreationists would be able to see mining and reclamation activities during all mining phases, but visual impacts would be particularly noticeable during Mining Phases 1 and 5. The remaining mining phases would result in minor impacts to visual resources, as most of the mining activities and impacts would be weakly visible to recreationists on the Arkansas River. A portion of the haul road would be slightly visible from KOP 3, but would not likely attract attention from recreationists in the Arkansas River. Once the alternative Sale Area has been reclaimed, the shape, contour, and contrast of the Sale Area compared to the surrounding natural landforms would be visible from KOP 3, but would not attract attention.

The impacts to visual resources would be negligible from KOP 6 due to the “mine from behind” approach for the alternative Sale Area. All mining and reclamation activities would be conducted on the southside (opposite side) of the primary ridgeline from this KOP. The only mining phase that would be visible from KOP 6 would be Mining Phase 2, and the impacts from this Mining Phase would not be noticeable to anyone traveling south on Highway 9. The haul road under Alternative C would not be visible from KOP 6. Once the alternative Sale Area has been reclaimed, the shape, contour, and contrast of the area compared to the surrounding natural landforms would not be visible from KOP 6.

Just as under Alternative A, the alternative Sale Area would be seeded, and vegetation cover would establish during the ongoing reclamation efforts at the Sale Area. Vegetation cover would use native species and closely resemble existing undisturbed vegetation of Webster Park and the hillsides surrounding Webster Park, south of the Parkdale Quarry and the Arkansas River. The landscape of Webster Park is shortgrass prairie on the lowland areas, bordered by hillside/montane areas on mountain scrubland dominated by sagebrush and mountain mahogany. The reclamation of the alternative Sale Area would result in the replacement of the current pinion-juniper plant community with grassland and shrub plant communities. Although the restored vegetation is expected to enhance wildlife habitat, it would likely create a visual contrast with the vegetation immediately adjacent to the alternate Sale Area. Accordingly, visual contrast related to the restored vegetation would be permanent and moderate following operation and reclamation.

During and post-reclamation, the topographic transformation of the alternative Sale Area would result in more noticeable visual impacts compared to the restored vegetation cover described above. Although the reclamation benches, which would be approximately 35 feet high with a width of approximately 30 feet, would be backfilled to an approximate reclamation slope of 1:1

(horizontal to vertical), the shape, form, and contour of the alternative Sale Area would be substantially different than pre-mining conditions.

Overall, visual impacts at the alternative Sale Area during mining operations, post-closure, and reclamation would be noticeable from the KOPs. There would be a change in the shape, contour, contrast, and vegetation cover through all mining phases and reclamation. However, because the mining operations and reclamation activities would be completed in six phases spanning 100 years, the overall impacts would be mitigated and decreased. Therefore, the VRM Class II status of the alternative Sale Area would be maintained. Mining and reclamation activities would be visible, but they would not attract the attention of the casual observer.

#### *Protective/Mitigation Measures*

As described above, concurrent reclamation of mine areas for which mining has been completed would be implemented. This would allow for vegetation to establish where mining has been completed, while mining activities are in progress elsewhere within the alternative Sale Area. Concurrent reclamation would result in reduced impacts to visual resources and visual contrast.

## 3.8.3. Cumulative Effects Analysis

### Issue 1: What is the extent of impacts on sensitive visual receptors resulting from the change in landforms during operations and post-mining?

The CESA for visual resources encompasses an area within 15 miles of the Sale Area. Beyond 15 miles, the Sale Area and associated mining and reclamation activities would either not be visible or would be considered as a minor element in the visual landscape. Prominent existing features within the CESA include the existing Parkdale Quarry and associated quarry facilities, Cañon City and the Fremont County Airport, and the Arkansas River.

Past, present, and RFFAs in the visual resources CESA have resulted, or would result in the direct disturbance of the natural and rural aesthetic quality of the area. Impacts to the natural and rural aesthetic quality have resulted from urbanization and population growth, roads and highways, mineral development, transmission lines, and grazing and agriculture activities. Development of reasonably foreseeable mining and infrastructure projects needed for additional urban development is anticipated across the CESA, especially in and around Cañon City. Wildfire has also impacted visual resources near the Sale Area. In the last two decades wildfires have burned approximately 8,000 acres. The regional area is an arid climate and if the current trend in climate change continues wildfire frequency may increase and have an increasing impact on visual resources. However, reclaimed and remaining features from the proposed sale in combination with the other past, present, and RFFAs within the CESA would continue to have long-term cumulative impacts to visual resources in the CESA but would be minor to moderate and blend into the existing landscape.

# 3.9. SOCIOECONOMIC CONDITIONS

**Issue 1: How would the proposed Parkdale Quarry expansion affect social and economic conditions in Fremont County?**

## 3.9.1. Affected Environment

The study area for assessing direct and indirect effects of the proposed quarry expansion on socioeconomic conditions is Fremont County as the Parkdale Quarry is centrally located within the county (Figure 3.9-1, Appendix C) and over 90 percent of current mine employees reside in Fremont County (Martin Marietta 2019c). The socioeconomic study area, depicting Fremont County, communities, the current and proposed mine site, and land status, can be seen in Appendix C, Figure 3.9-1, Socioeconomic Study Area. The existing mine and the proposed mine areas can be seen in Figures 2.2-1 and 2.2-2, Appendix C.

### 3.9.1.1. Population and Demographics

The population of Fremont County is 46,601 residents, the sixteenth most populous county in the state of Colorado during the 2013-2017 time period. The eastern third of Fremont is more densely populated and includes the largest communities in Fremont County, Cañon City and Florence. Cañon City is home to 16,298 residents, and the community of Florence, located approximately 8.5 miles southeast of Cañon City, has population of 3,845 residents during the 2013-2017 time period. Together, the communities of Cañon City, Florence, and the unincorporated town of Penrose (3,176) are home to almost 50 percent of the total population in Fremont County (USCB 2017a). The western two-thirds of the county is more mountainous and less developed. A small number of residents live in several unincorporated towns in the Arkansas River Valley (Fremont County Planning Commission 2015).

Over the period from 2010-2017, the Colorado state population expanded by over eight percent while the population of Fremont County declined 0.5 percent (USCB 2019). The population of Colorado is projected to increase by approximately 15 percent from 2020-2035, while Fremont County is projected to grow just 6 percent over that same period. The projected growth rate is more similar over the period from 2035 to 2050, with the state population increasing by approximately nine percent and the Fremont County population increasing by seven percent. The population of Fremont County is forecasted to reach 49,354 by 2030, 52,848 by 2040, and 56,406 by 2050 (DOLA 2018). From a recreation and tourism perspective, the BLM anticipates the Royal Gorge Extensive area to have a baseline visitation increase of six to nine percent due to general population growth and increased interest in recreation (BLM 2019d).

Fremont County is less ethnically diverse than Colorado as a whole, with fewer Hispanic residents. For the purposes of this analysis, a community is considered an environmental justice community if the total number of individuals living below the poverty level or total minority population, as defined by the U.S. Census Bureau (USCB), is 50 percent or more of the community or is “meaningfully greater” than the reference community (the State of Colorado). The BLM Colorado State Office applies a standard of five percentage points higher than in the comparison area to determine “meaningfully greater”. By applying this analysis criteria to the population estimates, none of Fremont County’s communities were identified as potential environmental justice low-income or minority communities (Table 3.18).

**Table 3.18. Number and Percent of People in Minority or Low-income Residents, 2013-2017**

| Geography | Total Population | White Alone | Black or African American Alone | American Indian or Alaskan Native Alone | Asian or Pacific Islander Alone | Other and Two or More Races | Hispanic or Latino[1] | Total Minority Population | Income Below Poverty Level[2] |
|---|---|---|---|---|---|---|---|---|---|
| **Colorado** | 5,436,519 | 4,576,201 (84.2%) | 221,155 (4.1%) | 51,406 (0.95%) | 173,351 (3.2%) | 414,406 (7.6%) | 1,157,200 (21.3%) | 1,704,543 (31.4%) | 11.5% |
| **Fremont County** | 46,601 | 42,068 (90.3%) | 2,145 (4.6%) | 575 (1.2%) | 366 (0.79%) | 1,447 (3.1%) | 6,058 (13.0%) | 9,565 (20.5%) | 15.8% |

Sources: USCB 2017b; USCB 2017a

[1] People who identify as Hispanic or Latino may be of any race.
[2] The USCB threshold for poverty in 2017 was $12,752 for an individual under the age of 65, $11,756 for an individual over the age of 65, and $25,094 for a family of four (USCB 2017b). Percent represents all below the poverty line.

### 3.9.1.2. Employment and Income

Table 3.19 shows the labor force statistics in Fremont County and Colorado. In 2017, the unemployment rate in Fremont was 4.1 percent, while the unemployment rate statewide was 2.7 percent. Historically, the unemployment rate in Fremont has been higher than the state and national unemployment rate. The unemployment rate across geographies has been declining since its peak in 2010-11 Figure 3.9-2, *Unemployment Rates, 2008-2017* (Appendix C shows the unemployment rate across geographies from 2008 to 2017.

**Table 3.19. Labor Force and Employment**

| Geography | Labor Force | | Employed | | Unemployed | | Unemployment Rate (percent) | |
|---|---|---|---|---|---|---|---|---|
| | ***2010*** | ***2017*** | ***2010*** | ***2017*** | ***2010*** | ***2017*** | ***2010*** | ***2017*** |
| Fremont County | 15,825 | 14,972 | 13,973 | 14,355 | 1,852 | 617 | 11.7% | 4.1% |
| Colorado | 2,724,420 | 2,992,418 | 2,486,405 | 2,911,081 | 238,015 | 81,337 | 8.7% | 2.7% |
| United States* | 153,889 | 162,075 | 139,064 | 155,761 | 14,825 | 6,982 | 9.6% | 4.4% |

Sources: BLS 2018a; BLS 2019

*Thousands

Per capita income in the study area is historically much lower than average per capita incomes for the state of Colorado and the United States. In 2017, per capita income in Fremont County was 38.8 percent lower than the average per capita income in Colorado. Additionally, per capita incomes in Fremont County have grown at a slower annual rate compared to the state and country as a whole (Table 3.20).

**Table 3.20. Per Capita Income, 2015-2017**

| Geography | 2015 | 2016 | 2017 | Percent Change, 2015-2017 |
|---|---|---|---|---|
| Fremont County | $32,185 | $32,780 | $33,422 | 3.8% |
| Colorado | $52,228 | $52,372 | $54,646 | 4.6% |
| United States | $48,940 | $49,831 | $51,640 | 5.5% |

Source: BEA 2019

Notes: Per capita personal income was computed using Census Bureau midyear population estimates. Estimates for 2010-2017 reflect county population estimates available as of March 2018.

In 2017, the largest employment industry in Fremont County is health care and social assistance, employing 2,224 people or 22 percent. The next largest employment sector is the combined Federal and local governments, employing 17 percent of the County, or 1,735 people, as the County hosts a number of prisons. Mining, quarrying, and oil and gas extraction is the highest paying private sector in the study area, with employees making more than $70,000 annually, but employs only an average of 79 people annually. Other important sectors include accommodation and food services, construction, manufacturing, arts, entertainment and recreation, and transportation and warehousing, depicted in Table 3.21.

Comparing 2017 to 2001, the County has seen job losses in the construction, manufacturing and information industries. The largest increase in jobs was in health care and the real estate/rental sectors (SCEDD 2017). A goal of the County is to improve the diversification of the local economy (SCEDD 2017).

**Table 3.21. Fremont County Establishments, Employment, and Wages by Sector and Industry, 2017**

| North American Industry Classification System Sector | | Annual Establishments | Annual Average Employment | Total Annual Wages | Annual Wages per Employee |
|---|---|---|---|---|---|
| **Private Sector** | | **890** | **8,386** | **$269,362,373** | **$36,430** |
| 62 | Health Care and Social Assistance | 127 | 2,224 | $76,343,990 | $34,327 |
| 44-45 | Retail Trade | 117 | 1,687 | $43,155,763 | $25,589 |
| 72 | Accommodation and Food Services | 76 | 1,105 | $16,813,094 | $15,210 |
| 23 | Construction | 122 | 655 | $27,474,186 | $41,961 |
| 31-33 | Manufacturing | 37 | 547 | $30,820,441 | $56,362 |
| 71 | Arts, Entertainment, and Recreation | 24 | 348 | $6,372,509 | $18,329 |
| 48-49 | Transportation and Warehousing | 26 | 297 | $9,433,286 | $31,780 |
| 56 | Administrative and Support and Waste Management and Remediation Services | 40 | 267 | $6,959,159 | $26,072 |
| 81 | Other Services (except Public Administration) | 59 | 245 | $5,708,024 | $23,322 |
| 54 | Professional, Scientific, and Technical Services | 80 | 234 | $10,158,068 | $43,395 |
| 52 | Finance and Insurance | 47 | 197 | $11,312,718 | $57,352 |
| 53 | Real Estate and Rental and Leasing | 51 | 157 | $4,705,622 | $29,909 |
| 42 | Wholesale Trade | 35 | 146 | $5,111,714 | $34,972 |
| 51 | Information | 15 | 89 | $4,152,500 | $46,833 |
| 21 | Mining, Quarrying, and Oil and Gas Extraction | 8 | 79 | $5,589,842 | $70,609 |
| 22 | Utilities | 8 | 49 | $3,342,970 | $67,763 |
| 11 | Agriculture, Forestry, Fishing and Hunting | 8 | 38 | $906,576 | $23,701 |
| 61 | Educational Services | 5 | 14 | $526,413 | $38,054 |
| 55 | Management of Companies and Enterprises | 4 | 7 | $472,377 | $69,982 |
| **Federal Government** | | **16** | **1,085** | **$75,666,483** | **$69,739** |
| 92 | Public Administration | 8 | 1,030 | $73,044,822 | $70,917 |
| 48-49 | Transportation and Warehousing | 8 | 55 | $2,621,661 | $47,667 |
| **State Government** | | **18** | **650** | **$26,978,472** | **$41,505** |
| 92 | Public Administration | 14 | 606 | $24,602,376 | $40,598 |
| 22 | Utilities | 4 | 44 | $2,376,096 | $54,002 |
| | **Total** | **924** | **10,121** | **$372,007,328** | **$36,756** |

Source: BLS 2018b

### 3.9.1.3. Housing

During the 2013- 2017 time period, Fremont County had 19,630 total housing units, of which 2,868 were vacant. Of these vacant housing units approximately 12 percent were for rent, 8 percent were for sale, and 39 percent were for seasonal, recreational, or occasional use.

Fremont County has a higher percentage of vacant housing units compared to the state, however a smaller percentage of these units are available for rent (USCB 2017b).

Table 3.22 below shows the housing unit estimates for the larger communities in proximity to the quarry. As of 2017, Cañon City is the municipality with the largest number of vacant housing units (646). There are approximately 1,814 vacant housing units in all other unincorporated areas of Fremont County.

**Table 3.22. Housing Unit Estimates by Municipality, 2017**

| Geography | Total Housing Units | Occupied Housing Units | Vacant Housing Units | Vacancy Rate |
|---|---|---|---|---|
| Cañon City | 7,362 | 6,716 | 646 | 8.8 |
| Florence | 1,765 | 1,598 | 167 | 9.5 |
| Unincorporated Area | 9,779 | 7,965 | 1,814 | 18.6 |
| **Total** | **18,906** | **16,279** | **2,627** | **12.3** |

Source: DOLA 2017b

Additional indicators addressing the relative cost of housing in the study area are shown in Table 3.23. The median value of an owner-occupied unit in the study area is $160,000, less than the state average of over $285,000. The values for Selected Monthly Owner Costs as a Percentage of Household Income (SMOCAPI), and Gross Rent as a Percentage of Household Income (GRAPI) provide an indicator of the affordability of housing in the study area compared to the state average; specifically, the cost of owning or renting a home relative to income. The percentage of units where SMOCAPI and GRAPI is 35 percent or more is slightly higher in Fremont County compared to the state average, however this difference is not significant.

**Table 3.23. Selected Housing Cost Indicators, 2013-2017**

| Geography | Median Value of Owner-Occupied Units | Owner Occupied Units with a Mortgage | | | Occupied Units Paying Rent | |
|---|---|---|---|---|---|---|
| | | *Percent*[1] | *Median SMOC* | *SMOCAPI 35% OR MORE* | *Median Gross Rent*[2] | *GRAPI 35% OR MORE* |
| Fremont County | $160,000 | 56.7% | $1,132 | 22.5% | $786 | 41.5% |
| Colorado | $286,100 | 72.2% | $1,623 | 20.7% | $1,125 | 41.3% |

Source: USCB 2017f

[1] Percentage of owner-occupied housing units.
[2] For occupied units paying rent (does not include rent on vacant units).

SMOC: Selected Monthly Owner Costs (includes mortgage payments, real estate taxes, insurance, utilities, fuels, and condominium fees).
SMOCAPI: Selected Monthly Owner Costs as a Percentage of Household Income.
Median Gross Rent: Contract rent plus estimated cost of utilities and fuels if paid by the renter.
GRAPI: Gross Rent as a Percentage of Household Income.

### 3.9.1.4. Community Facilities and Services

**Water Supply and Treatment**

The Parkdale Quarry mine uses approximately 1,500 gallons of water per minute, mainly for dust control. On-site water is obtained from tributary groundwater and is supplemented when needed by water taken from the Tallahassee Creek located adjacent to the mine. Taking water from Tallahassee Creek is approved under a State permit. Process water is not discharged from the mining site. Water that is discharged from the site is sampled on a monthly basis to ensure it meets Clean Water Act and State of Colorado standards (Resource Economics LLC 2019).

### 3.9.1.5. Public Finance

County and city governments in the study area are funded mostly by property taxes and intergovernmental transfers from federal and state sources. Combined property, sales, and use tax revenue are projected to be over $12 million in 2017 for Fremont County general fund revenue. Those tax revenue streams supported 71 percent of total Fremont County general fund revenue. Approximately 7 percent of Fremont County revenue was anticipated to come from State and Federal intergovernmental revenues, such as grants, licenses, permit, and other miscellaneous revenues (Fremont County Finance Office 2017). The Fremont County General fund accounts for 49 percent of estimated revenue and 50 percent of estimated expenditures. Additional financing to cover the excess of expenditures beyond revenue stems from intergovernmental transfers.

Payment in lieu of taxes (PILT) are payments from the Federal Government to local governments to help compensate for lost property taxes resulting from tax-exempt Federal lands located within the local jurisdiction. More than half of the land in Fremont County is federal or state public land, managed by the U.S. Forest Service, the BLM, or the Colorado Parks and Wildlife. Local governments use PILTs to pay for various government services such as law enforcement and infrastructure. The payments are calculated based on acreage of eligible lands within the county, population, and other Federal transfers such as mineral royalties (U.S. Department of the Interior 2019). Table 3.24 provides the total PILTs made to the counties in from 2015 to 2019.

### Table 3.24. Fremont County PILT Payments, 2015-2019

| Year | Payment | Total Acres |
|---|---|---|
| 2015 | $1,076,954 | 455,215 |
| 2016 | $1,111,743 | 455,253 |
| 2017 | $1,138,110 | 455,253 |
| 2018 | $1,176,069 | 455,254 |
| 2019 | $1,177,027 | 455,254 |
| 2019 Average Payment per Acre | $2.59 | |

Source: U.S. Department of the Interior, n.d.

Table 3.25 depicts the assessed value, tax rate, and property taxes from 2016 to 2018. For the existing Parkdale Quarry located on its private property, Martin Marietta paid an average of over $23,000 annually in property taxes to Fremont County.

### Table 3.25. Parkdale Quarry Property Tax Assessed Valuations and Rates in Fremont County, 2016-2018

| Year | Assessed Value | Tax Rate | Property Tax |
|---|---|---|---|
| 2016 | $508,088 | 0.048048 | $24,413 |
| 2017 | $434,002 | 0.054132 | $23,493 |
| 2018 | $370,858 | 0.059241 | $21,970 |
| **Average*** | **$437,649** | **0.053807** | **$23,292** |

Source: Fremont County Treasurer's Office 2019

*Not discounted

Table 3.26 presents Fremont County’s permitted mining operations. Total permitted acreage in Fremont County is over 220,000 acres. Fremont County earns an annual fee of over $51,000 from permitted mine operations.

### Table 3.26. 2018 Fremont County Permitted Mining Operations, Acreage, and Fee by Mine Type

| Mine Type | Acreage | Fee |
|---|---|---|
| Other | 21.50 | $1,114 |
| Surface | 219,439 | $49,790 |
| Underground | 1,159 | $75 |
| **Total** | **220,620** | **$50,979** |

Source: Colorado Division of Reclamation, Mining, and Safety 2019b

The Parkdale Quarry currently does not pay revenue to the BLM based on its operations, as they are conducted on lands where Martin Marietta owns the mineral interests (Resource Economics LLC 2019).

### 3.9.1.6. Social Values

There are large areas of state-owned land that are essential features of recreational opportunity and scenic quality of the County (State of Colorado 2019d). Active land use in the county includes mining and mineral processing, commercial trade, agriculture and livestock grazing, manufacturing, and recreation and tourism. The largest river on Colorado's eastern slope, the Arkansas River, bisects the county and acts as a key source of recreation and water supply (State of Colorado 2019d).

**Mining**

Beginning in the 1800s, the "Colorado Mineral Belt" was the source of much of the State's wealth for decades. Colorado has a variety of metals and minerals such as silver, gold, industrial mineral, and coal (Colorado School of Mines 2019). The Fremont County historic mine district is composed of 19 districts and is pictured in Appendix C, Figure 3.9-3, Fremont Historic Mining Districts.

The mining industry and associated economic activity has historically played a large part of the Fremont County local economy. As described in Section 3.9.1.2, mining employment and secondary services related to mining operations continue to contribute to the Fremont County economy. While only 79 people are employed in the Mining, Quarrying, and Oil and Gas Extraction sector in 2017 in Fremont County, these workers are the second highest paid workers in the county, on average.

**Tourism and Recreation**

With Royal Gorge located in Fremont County, the County also desires to continue development of its outdoor recreation sector (SCEDD 2017) and to provide adequate parks, recreational facilities and open space while maintaining the rural character of the county (Fremont County 2015). The region offers hiking, biking, natural landscapes, and geologically important sites. The Arkansas River, which abuts the existing Martin Marietta processing plant site, is one of the most popular whitewater rafting locations in the nation, and is also a popular site of camping, biking, horseback riding, and sightseeing. In 2018, approximately 20 percent of the jobs in the County are in travel and tourism related industries with an average annual income of $17,449. Many of these jobs are less 40 hours per week (Headwaters Economics 2019).

The BLM anticipates the Royal Gorge Extensive Recreation area to have a baseline visitation increase of six to nine percent due to general population growth and increased interest in recreation (BLM 2019d). The proposed quarry area is in a rugged landscape, which is difficult to access for recreation and there is not a route currently available for the public to easily access the site. Given its limited use and lack of formal trails, the BLM does not maintain any trail counts in the proposed area. The BLM does not anticipate a substantive change from the baseline in visitation under Alternative A in the Mine Plan Area.

**Rail**

The Rock & Rail Railroad is owned by Rock & Rail LLC, a subsidiary of Martin Marietta. Currently the Rock & Rail Railroad employs 24 people annually, however, with increased production under Alternative A, direct employment associated with the rail operations could increase by 6 to 10 annual jobs. The Royal Gorge Route Railroad tourist train is also a joint owner of the track through Royal Gorge. The train transports approximately 100,000 passengers per year (Royal Gorge Route Railroad 2017). Currently, the Parkdale Quarry's operations result in three to five trains per week with approximately 48 cars per train as well as approximately 28 trips per day of 12-ton haul trucks (Martin Marietta 2019b).

## 3.9.2. Environmental Effects

Potential direct economic impacts of the Sale Area include changes in employment, income, business costs, and tax revenue to local, State, and Federal government entities. Changes in employment and income can result in indirect socioeconomic impacts, such as changes in population, which can lead to community impacts on housing, infrastructure, and other government services. Table 3.27 presents a summary overview of anticipated investment, employment, and production under the various alternatives.

**Table 3.27. Alternatives Overview**

| | Alternative A (Proposed Action) | Alternative B (No Action) | Alternative C (Alternate Sale Area) |
|---|---|---|---|
| Construction | $91 million | $61 million | $91 million |
| Operations (2024-2050) | 37-47 quarry employees<br>30-34 rail employees<br>67-81 total employees | 27 quarry employees<br>24 rail employees<br>51 total employees | 37-47 quarry employees<br>30-34 rail employees<br>67-81 total employees |
| Operations (2051-2120) | 37-47 quarry employees<br>30-34 rail employees<br>67-81 total employees | 0 employees | 37-47 quarry employees<br>30-34 rail employees<br>67-81 total employees |
| Annual Production | 4.0-million tons per year | 0.8-million tons per year | 4.0-million tons per year |

Sources: Resource Economics LLC 2019; Martin Marietta 2019d; Martin Marietta 2019e

### 3.9.2.1. Direct and Indirect Effects from Alternative A

**Issue 1: How would the proposed Parkdale Quarry expansion affect social and economic conditions in Fremont County?**

As described in Chapter 2, the mine plan area is expected to be fully operational in 2024, under the Alternative A. Expansion of mining activity at the site would provide long-term viability for the quarry, extending its useful life from the currently forecast 15 to 30 years under Alternative B, the No Action Alternative (depending on production) (Martin Marietta 2019d) to over 100 years into the future. Martin Marietta estimates that the proposed approximate 698-acre expansion of the granite deposit pit footprint to the north onto the BLM lands would add an estimated 400-million to 500-million additional net tons of minable reserves to Martin Marietta's currently permitted reserves. Alternative A would sustain production of up to 4-million net tons of deposit per year, extending the mine life to 100 or more years at the increased production rate. Martin Marietta's contractor estimates, given the forecasted increase in aggregate prices, that the value of sales from the quarry over the first five and fifteen years will be $120 million and $629 million, respectively (Resource Economics LLC 2019).

There are two main drivers of socioeconomic impacts associated with Alternative A. The first is the increased economic activity that would result from the construction, operations, and reclamation phases of the proposed expansion, which include employment, local expenditures, and production. The second is the reduced availability of public lands for other uses such as recreation and livestock grazing. These two drivers have the potential to affect earnings by the workforce in the study area, the population of the study area, the demand for housing and public services, local fiscal revenues and social values.

### Employment and Income

Under Alternative A, an additional $25 to $30 million beyond the capital expenditures for Alternative B would be purchased from 2020 through 2023. As the capital equipment is anticipated to be purchased outside of Fremont County, there is no anticipated direct, indirect, or induced spending or employment in Fremont County (Martin Marietta 2019e).

Expansion of mining services under Alternative A would create 10 to 20 additional annual direct jobs. According to the BLS and depicted in Section 3.9.1.2, mining jobs are the second highest paying jobs in Fremont County, with employees earning more than $70,000 per year on average. The current direct annual employment and estimated direct employment under Alternative A is shown in Table 3.28.

In addition to the direct employment associated with the expansion of mining activity at the quarry itself, Alternative A has broader implications for the employment associated with the Rock & Rail Railroad servicing the site. The Rock & Rail Railroad is owned by Rock & Rail LLC, a subsidiary of Martin Marietta. Currently the Rock & Rail Railroad employs 24 people annually, however, under Alternative A, direct employment associated with the rail operations could increase by 6 to 10 annual jobs. The Royal Gorge Route Railroad tourist train is also a joint owner of the track through Royal Gorge. The train transports approximately 100,000 passengers per year (Royal Gorge Route Railroad 2017), however the proposed expansion is not anticipated to have a substantial adverse impact on tourist train operations (Martin Marietta 2019d).

**Table 3.28. Alternative A Associated Annual Employment**

| Labor Category | Number of Employees at Existing Quarry | Increase in Direct Employees Under Alternatives A and C |
|---|---|---|
| ***Parkdale Quarry*** | | |
| Plant Manager | 1 | 0 |
| Mining Manager | 1 | 0 |
| Quality Control Technician | 1 | 0 |
| Supervisor (Lead Man) | 3 | 1 |
| Equipment Operator | 10 | 1-4 |
| Truck Driver (Onsite Haul Trucks) | 2 | 2-4 |
| Scale Operator / Office Manager | 1 | 1 |
| Plant Operator | 1 | 0-1 |
| Rail Loader | 0 | 1-2 |
| Customer Service Representative | 1 | 0-1 |
| Maintenance | 3 | 2 |
| Laborer | 3 | 2-4 |
| **Total** | **27** | **10-20** |
| ***Rock & Rail Railroad*** | | |
| General Manager | 1 | 0 |
| Distribution Supervisor | 1 | 0 |
| Supervisor (Lead Man) | 3 | 1 |
| Rail Engineer | 5 | 1-2 |
| Rail Engineer (Training) | 4 | 1-2 |
| Office Manager | 1 | 0 |
| Plant Operator | 2 | 1 |
| Equipment Operator | 3 | 1 |
| Rail Distribution Manager | 1 | 0 |
| Maintenance | 1 | 0-1 |
| Laborer | 2 | 1-2 |
| **Total** | **24** | **6-10** |

Source: Martin Marietta 2019d

Under Alternative A, an additional 10 to 20 employees would be expected to be working at the site, whether directly employed by Martin Marietta, or employed by mining, transportation or construction contractors. Another 6 to 10 employees would be likely be employed by the railroad line serving the quarry. The actual direct employment totals would vary depending on market demand for aggregate materials, but total direct employment is expected to be no less than the current 51 employees shown in Table 3.29. Martin Marietta expects that under Alternative A, production necessary to meet market demand will increase from 0.8 million tons in 2019 to

4.0 million tons in 2039 (Resource Economics LLC 2019). Because the Parkdale Quarry already has existing infrastructure for the processing and transportation of materials in place, the economic impacts associated with the initial construction of the proposed expansion would be limited. Table 3.29 depicts the number of employees under the baseline and Alternative A.

**Table 3.29. Summary of Employment for Baseline and Alternatives**

| Segment | Current Number of Employees | Employees Under Alternative A and C | Additional Employees |
|---|---|---|---|
| Parkdale Quarry | 27 | 37-47 | 10-20 |
| Rock & Rail Railroad | 24 | 30-34 | 6-10 |
| **Total** | **51** | **67-81** | **16-30** |

Source: Resource Economics LLC 2019

### Economic Modeling Results

A discussion of the economic impact analysis and the results are presented in the Socioeconomics Appendix I. Under the “low estimate” for direct additional employment (10 direct additional quarry employees and 6 direct additional railroad employees), Alternative A would support over 26 total jobs, $1.9 million of labor income, and $6.2 million of regional output, annually. Under the “high estimate” for direct additional employment (20 direct additional quarry employees and 10 direct additional railroad employees), Alternative A would support over 49 total jobs, $3.45 million of labor income, and $11.5 million of regional output, annually.

### Population

Alternative A would generate employment. Martin Marietta estimates that total direct employment associated Alternative A could range from 16 to 30 direct new employees and 26 to 49 total jobs. As stated in Section 3.9.1.2, Fremont County has over 600 unemployed residents, as of 2017. Because the jobs associated with or dependent on construction aggregate mineral resource extraction are typically some of the highest paying jobs in the community and generally do not require a college degree (Martin Marietta 2017), it is expected that the additional employees needed would be hired locally. Therefore, impacts on the local population from Alternative A would be negligible.

In 2017, the largest employment industry in Fremont County is health care and social assistance, employing 2,224 people or 22 percent. The next largest employment sector is the combined Federal and local governments, employing 17 percent of the County, or 1,735 people, as the County hosts a number of prisons. Mining, quarrying, and oil and gas extraction is the highest paying private sector in the study area, with employees making more than $70,000 annually, but employs only an average of 79 people annually. Other important sectors include accommodation and food services, construction, manufacturing, arts, entertainment and recreation, and transportation and warehousing, depicted in Table 3.18. Comparing 2017 to 2001, the County has seen job losses in the construction, manufacturing and information industries. The largest increase in jobs was in health care and the real estate/rental sectors (SCEDD 2017). A goal of the County is to improve the diversification of the local economy (SCEDD 2017).

### Housing & Public Services

Alternative A is expected to yield a negligible change in population, thus no changes in demand for housing and public services are expected.

### Local Fiscal Revenues

As discussed in Section 3.9.1.5, Public Finance, the main source of tax revenues are property taxes. On an annual average, Martin Marietta paid $23.3 thousand in property taxes to Fremont County from 2015 to 2017. This value corresponds to approximately 0.1 percent of Fremont County property tax revenue in FY17. Although Martin Marietta's property ownership is not anticipated to change under Alternative A, Fremont County property tax revenue is anticipated to increase due the investment in new processing equipment and additional mobile equipment. PILT payments from the Department of the Interior, as discussed in Section 3.9.1.5, would remain unchanged under Alternative A.

Due to the anticipated increased production of aggregates under Alternative A, an increase in revenue associated with the mine plan and severance taxes to Fremont County can be expected. Martin Marietta pays a severance tax to Fremont County, which is 5.974 percent, and is specific to aggregate extraction. This tax is in addition to other local taxes paid for property, etc. Martin Marietta is required to pay BLM fair market value for any aggregate materials removed. Currently, the fair market value for crushed stone aggregate is $0.79 per short ton. This revenue paid to BLM goes into the U.S. Federal Treasury. Together with other property-related costs, expenditures are estimated to be $1.3 million in 2024 (Resource Economics LLC 2019) when the quarry is fully operational. Property-related costs include such items specific to activities occurring on the BLM land like weed control, dust control, and the maintenance of infrastructure placed on the BLM property (Martin Marietta 2019d).

In addition, local expenditures associated with Alternative A would pay sales taxes. A portion of sales tax collection is distributed to the counties, cities and school districts where they are collected. The modeling results also produces tax estimates. Total additional taxes to localities, the State of Colorado, and the Federal Government could range from over $600,000 to over $1.1 million. The results are presented in the Socioeconomics Appendix I.

### Social Values

Alternative A would extend mining activity in the study area. This would contribute to the continuation of mining as a main form of livelihood to the local population and would tend to reinforce existing social values rather than alter them.

### Rail and Truck Traffic

Alternative A is anticipated to add one to three additional trains per week. The trains would likely increase in length from the current 48 cars to approximately 90 cars. The proposed expansion is not anticipated to have a substantial adverse impact on tourist train operations.

Current truck traffic is estimated as an average daily number of 28 round trips per day. Martin Marietta estimates that truck traffic would remain the same under Alternative A (Martin Marietta 2019b). Due to no anticipated change in truck traffic, the proposed expansion is not anticipated to have an adverse impact on traffic in the area. Table 3.30 presents a summary of anticipated rail and truck traffic.

**Table 3.30. Summary of Rail and Truck Traffic for Baseline and Alternatives**

| Haul Type | Current Level of Rail and Truck Activity | Anticipated Rail and Truck Activity Under Alternative A and Alternative C |
|---|---|---|
| Rail | 3 to 5 48-car trains/week | Phase 1: 3 to 5 100-car trains/week<br>Phase 2: 5 to 10 100-car trains/week |
| Truck | 28 trips/day of 12-ton haul trucks, 240 days/year | 28 trips/day of 12-ton haul trucks, 240 days/year |

Source: Martin Marietta 2019b

### Noise

While a noise study has not been conducted for the operation, Alternative A would utilize the processing equipment for current operations on private land and would move mining and some processing activities further from the Highway 50 corridor, thus potentially reducing noise impacts from those operations. Regarding the blast schedule, the hours of operation are unlikely to substantially change from those currently permitted. Blasting hours would be expected to remain from 10:00 AM to 5:00 PM, Monday through Friday, as set forth in the CUP currently in effect for the Parkdale Quarry (Martin Marietta 2019d).

## 3.9.2.2. Direct and Indirect Effects from Alternative B

### Issue 1: How would the proposed Parkdale Quarry expansion affect social and economic conditions in Fremont County?

Alternative B assumes that the proposed Mineral Materials Sale for the Parkdale Quarry Mine expansion is not approved by the BLM. Expected mining capital expenditures under Alternative B would include approximate expenditures of $3 million for a new bridge, $4 million for rail upgrades, and $54 million for a new processing plant over 2020 to 2023 (Table 3.25). As for mining operations, Martin Marietta anticipates that, based on the current customer demand of aggregates for concrete, the quarry can expect a remaining life of 15 to 30 years after which the quarry would cease operations. However, if operations were expanded to meet demand for additional products (railroad ballast, rip rap and erosion control materials, structural fill) within other markets, operations could be expected to cease in 10 to 20 years (Martin Marietta 2019d).

Under Alternative B, there would be no change in the social and economic conditions in the local economy and Fremont County because the mine would continue to operate as currently permitted. Employment is expected to be consistent with current levels, depicted in Table 3.25 for the rest of the remaining mine life, 15 to 30 years, as described above. Thus, local employment and labor earnings are not expected to change, nor demand in housing, public services, or local fiscal revenues, or quality of life, for the rest of the remaining mine life.

Under Alternative B, upon final closure of the quarry Martin Marietta would no longer require the use of the Rock & Rail Railroad and therefore ongoing contribution to maintenance costs associated with the railroad would cease. This reduction in maintenance funding would adversely impact the ability of the Royal Gorge Route Railroad to maintain operation of the tourist train through the Royal Gorge.

### 3.9.2.3. Direct and Indirect Effects from Alternative C

**Issue 1: How would the proposed Parkdale Quarry expansion affect social and economic conditions in Fremont County?**

Although the acreage of disturbance is reduced under Alternative C in comparison to Alternative A, the amount of aggregate material that would be produced is essentially the same under both alternatives, therefore the environmental effects of Alternative C on socioeconomic conditions at the local, regional, and Fremont County scale would be the same as described for Alternative A in section 3.9.2.1. As a result, the socioeconomic impacts of Alternative C would be the same as described for Alternative A.

## 3.9.3. Cumulative Impacts

The CESA for socioeconomic effects encompasses Fremont County, the same area as the study area. The socioeconomic effects of past and present actions for the Parkdale Quarry Mine are reflected in the affected environment. Any cumulative effects with the alternatives are reflected in the discussion of the direct and indirect environmental effects. The discussion below focuses on RFFAs.

As previously discussed, key drivers of socioeconomic impacts associated with Alternatives A and C include increased employment, local expenditures, revenues, and production. There would be reduced availability of public lands for other uses. RFFAs that would have a cumulative effect on local employment, expenditures and production include mining operations, exploration activities, grazing and agriculture, and utility and infrastructure development. These activities are expected to continue at levels similar to present levels and what occurred in the recent past. Three aggregate mining operations in Fremont County are undergoing reclamation and closure: the Vallie Gravel mine located on the south side of the Arkansas River; the Hardscrabble mine, about a mile west of the Portland plant on Highway 120; and the Grisenti Farms mine located near Highway 115 on the north side of the Arkansas River. It is unknown whether other aggregate mines may develop or expand operations in the future in Fremont County. Alternatives A and C would contribute to the socioeconomic effects and cumulative impacts for an additional 60-80 years beyond Alternative B, the No Action Alternative.

# CHAPTER 4. CONSULTATION AND COORDINATION

This chapter summarizes agency and public consultation and coordination conducted by the BLM, prior to and during the preparation of this EIS.

## 4.1. PUBLIC PARTICIPATION AND SCOPING

This EIS was prepared in consultation and coordination with various federal, state, and local agencies, organizations, and individuals. Agency consultation and public participation have been accomplished through a variety of formal and informal methods, including scoping meetings, responses to e-mails, meetings with individual public agencies and interest groups. This section summarizes these activities.

In order to identify agency requirements and public concerns related to the proposed project the BLM has conducted a public involvement process that is intended to: (1) broaden the base of available information to support decision making; (2) inform the public about proposed actions and the potential impacts resulting from those actions; and (3) ensure that public concerns and needs are understood and addressed by agency decision makers.

The CEQ, through NEPA, requires the BLM to provide opportunities for the public to participate at four specific points in the EIS process: the initial project scoping period, the review and comment period of the Draft EIS, the review of the Final EIS, and the receipt of the Record of Decision (ROD). These opportunities are defined as follows:

- Scoping: The public is provided a 30-day scoping period to disclose potential concerns and issues associated with the Proposed Action. Information obtained by the BLM and other agencies during the public scoping period is combined with issues identified by lead and cooperating agencies. The summarization of these issues form the scope of the alternatives and analysis in the EIS.
- Draft EIS Comment Period: A minimum 45-day Draft EIS comment period is initiated by the publication of a Notice of Availability (NOA) for the Draft EIS in the Federal Register (FR). Members of the public are encouraged to provide comments on the Draft EIS via email or hardcopy to the address listed in the NOA. These public comments are combined with comments from the lead and cooperating agencies to form the basis for revising the Draft EIS into the Final EIS.
- Final EIS Review: A 30-day Final EIS availability period is initiated by the publication of the NOA for the Final EIS in the FR.
- ROD: Subsequent to the 30-day availability period for the Final EIS, the ROD would be prepared.

## 4.1.1. Scoping

The formal public scoping process began with publication of a NOI in the FR on July 31, 2019 (FR Volume 84, Number 147). The BLM invited the public to submit comments during the 30-day scoping period from July 31, 2019, through August 30, 2019. The NOI notified the public of the BLM's intent to prepare an EIS, provided information about the Proposed Action, described the purpose of the scoping process, and identified methods to provide comments.

The BLM hosted a scoping meeting on August 9, 2019, for the public and other interested parties to learn about and submit comments on the Parkdale Quarry Expansion. The BLM used an open house meeting format to encourage open and informal dialog between the public and agency representatives and allowed attendees to learn about the proposed Parkdale Quarry Expansion at their own pace. Representatives from the BLM included the BLM project manager and members of the BLM interdisciplinary team and management from the RGFO and the Colorado State Office. MM was also in attendance to answer technical questions from the public, as needed.

The BLM received a total of 10 comment submittals (e.g., letter, comment form, or email) during the scoping period, resulting in a total of 39 comments. Most of the comments the BLM received were from federal and state agencies. Scoping comments were used to help determine the scope of issues to be addressed and help identify the significant issues related to the Proposed Action. The Public Scoping Summary Report for this EIS (BLM 2019e) provides a detailed table listing each individual comment, its source, and where the comment would be addressed in the EIS. Table 4.1 details the distribution of scoping comment documents by organization type.

**Table 4.1. Number of Comment Documents by Organization Type**

| Affiliation Category | Number of Comment Documents |
|---|---|
| No Affiliation Included or Withheld | 6 |
| Interest Group | 2 |
| Business | 0 |
| State/Local Government | 1 |
| State Agency | 1 |
| Tribal | 0 |
| **Total** | **10** |

Table 4.2 presents the number of comments by issue category.

**Table 4.2. Number of Individual Comments by Issue Category**

| Issue Category | Number of Comments Per Issue Category |
|---|---|
| Air Quality and Climate Change | 3 |
| Alternatives | 2 |
| Analysis Methods and Assumptions | 5 |
| Cultural Resources | 0 |
| Fish and Wildlife | 6 |
| Hazardous or Solid Wastes | 0 |
| Lands and Realty | 0 |
| Laws, Regulations, Guidance | 1 |
| Mineral Resources | 0 |
| NEPA Process | 0 |
| Noise | 2 |
| Other or General Issues | 0 |
| Proposed Action | 0 |
| Purpose and Need | 0 |
| Reasonably Foreseeable Actions | 0 |
| Recreation | 1 |
| Socioeconomics and Environmental Justice | 2 |
| Tribal Treaty Rights and Trust Responsibilities | 0 |
| Unsupported Position Statement | 7 |
| Visual Resources | 3 |
| Water Quality | 2 |
| Wilderness, and ACECs | 5 |
| **Total** | **39** |

## 4.1.2. Public Review of the Draft EIS

The Draft EIS will be available for a 45-day public review and comment period from the date the NOA is published in the FR. A public meeting was held in Cañon City, Colorado, during the 45-day comment period.

# 4.2. CONSULTATION AND COORDINATION WITH FEDERAL, STATE, AND LOCAL AGENCIES, AND TRIBES

Issues related to agency consultation and review included mining regulation and reclamation, biological resources, cultural resources, socioeconomics, air quality, and land and water management. Consultations regarding historic properties were conducted pursuant to the National Historic Preservation Act and implementing regulations at 36 CFR 800. The USFWS provided an official list of Threatened and Endangered Species that could potentially occur within the Project area. As the state agency with jurisdiction and expertise related to wildlife, CPW participated as a cooperating agency in discussions regarding bighorn sheep habitat, reclamation strategy, and other wildlife issues. Fremont County participated as a cooperating agency during discussions regarding economic, social, and environmental conditions within the county.

Executive Order 13084 directs the BLM to establish regular and meaningful consultation and collaboration with Native American Tribal governments on the development of regulatory policies and permit approvals for proposed projects that could substantially or uniquely affect tribal communities. The BLM sent letters to the tribal representatives listed in Section 4.3.5, *Tribal Organizations*.

# 4.3. LIST OF CONTACTS

The following agencies, businesses, organizations, and individuals were contacted during the preparation of the Draft EIS.

## 4.3.1. Federal Agencies

- Bureau of Land Management – Colorado State Office, Lakewood
- Bureau of Land Management – Washington D.C.

## 4.3.2. State Agencies

- Colorado Department of Natural Resources
- Colorado Parks and Wildlife
- Colorado Division of Reclamation, Mining and Safety
- Colorado Division of Public Health and Environment
- Colorado State Historic Preservation Office

## 4.3.3. Elected Officials

- Michael Bennet – U.S. Senator
- Cory Gardner – U.S. Senator
- Diana DeGette – U.S. Representative

## 4.3.4. Local Agencies

- Fremont County Commissioners

## 4.3.5. Tribal Organizations

The BLM consulted with the following 16 tribes regarding the proposed mineral material sale:

- Apache Tribe of Oklahoma
- Cheyenne and Arapaho Tribes of Oklahoma
- Cheyenne River Sioux Tribe
- Comanche Nation of Oklahoma
- Crow Creek Sioux
- Eastern Shoshone
- Jicarilla Apache Nation
- Kiowa Tribe of Oklahoma
- Northern Arapaho Tribe
- Northern Cheyenne Tribe
- Northern Ute Tribe
- Oglala Sioux Tribe
- Rosebud Sioux Tribe
- Southern Ute Tribe
- Standing Rock Lakota Tribe
- Ute Mountain Ute Tribe

## 4.3.6. Newspapers and Libraries

- Cañon City Daily Record
- KKTV
- KUNC
- Chaffee County Times
- Arkansas Valley Voice
- Prairie Mountain Media

## 4.3.7. Private Organizations and Companies

- Trout Unlimited
- Rocky Mountain Bighorn Society
- Rocky Mountain Elk Foundation
- Wild Sheep Foundation
- Ducks Unlimited
- Nature Conservancy
- Mule Deer Foundation
- Audubon Society
- The Sierra Club
- Conservation Colorado
- The Wilderness Society
- Wild Connections
- Cañonland Walkers and Hikers
- Theodore Roosevelt Conservation Partnership
- Western Resource Advocates
- Colorado Wildlife Federation
- Central Colorado Wilderness Coalition
- Colorado Stone Sand & Gravel Association
- American Exploration & Mining Association
- Echo Canyon River Expeditions
- Arkansas River Outfitters Association

## 4.3.8. Individuals

- Grazing Permittee

# CHAPTER 5. LIST OF PREPARERS

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| Resource/Responsibility | Name |
|---|---|
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| RGFO Assistant Manager | Mark Ames |
| Assistant Field Manager – Renewables | Kalem Lenard |
| NEPA Coordinator | Roger Sayre |
| NEPA Coordinator | Martin Weimer |
| Public Affairs | Brant Porter |
| Air Resources | Chad Meister |
| Wildlife Resources and Special Status Species | Matt Rustand |
| Soils and Water Resources | John Smeins |
| Wild & Scenic Rivers, Water Rights | Roy Smith |
| NEPA/Editor | Marie E. Lawrence |
| Fisheries and Riparian Resources | David Gilbert |
| Cultural Resources and Tribal Consultation | Monica Weimer |
| Paleontological Resources, Wastes (Solid or Hazardous) | Melissa Smeins |
| Economics, Environmental Justice | Amy Stillings |
| Invasive Plants | Aaron Richter |
| Recreation, Visual Resources, WSAs/ACECs/ /Other, Wilderness Characteristics | Linda Skinner |
| Lands and Realty | Veronica Vogan |
| Forest Management | Jeremiah Moore |
| Range Management, Prime & Unique Farmlands, Vegetation | Jeff Williams |
| Cadastral Survey | Rebecca Bruno |
| Fire and Fuels Management | Glenda Torres |

# 5.2. ICF EIS TEAM

| Resource/Responsibility | Name |
|---|---|
| Project Director | Madeline Terry |
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| Deputy Project Manager | Andrew Newman |
| Project Coordinator | Dan Nally |
| Livestock Grazing, Recreation | Chris Dunne |
| Fish, Wildlife, and Special Status Species | Sara Stribley |
| Soils and Reclamation | Alex Bartlett |
| Noxious Weeds and Invasive Plant Species | Zach Turner |
| Vegetation, Riparian, and Wetlands | Katie Wilson |
| Cultural and Paleontological Resources | Jenna Wheaton |
| Visual Resources | Jeff Gutierrez |
| Noise | Jason Volk |
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| Socioeconomics | Claire Munaretto |
| Administrative Record | Mikenna Wolff |
| Editor | Karen DiPietro |

[1] Whetstone Associates

***Draft Environmental Impact Statement***
***Parkdale Quarry Expansion Project***

# *Appendix A*

References

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# APPENDIX A REFERENCES

5280Fire. 2019. *Florence Fire Protection District*. Available online: https://5280fire.com/home/colorado-fire-apparatus-stations/fremont-county/florence-fire-protection-district/.

Agile Stone Systems Inc. 1997. Colorado Department of Reclamation, Mining, and Safety; Regular 112c Permit Application. Exhibit I: Soils Information. July 8, 1997.

BEA (Bureau of Economic Analysis). 2019. *Regional Data, GDP & Personal Income: CAINC1 Personal Income Summary: Personal Income, Population, Per Capita Personal Income. March 6, 2019*. Retrieved from Bureau of Economic Analysis, Local Area Personal Income and Employment: https://apps.bea.gov/iTable/iTable.cfm?reqid=70&step=1&isuri=1.

BLM (Bureau of Land Management). 1986a. Record of Decision for Northeast Resource Management Plan. September 1986. Cañon City, CO: United States (U.S.) Department of the Interior, Bureau of Land Management.

____. 1986b. Manual 8431 – Visual Resource Contrast Rating. Available online: http://blmwyomingvisual.anl.gov/docs/BLM_VCR_8431.pdf.

____. 1996. Royal Gorge Resource Area Record of Decision and Approved Resource Management Plan. May 1996. Cañon City, CO: U.S. Department of the Interior, Bureau of Land Management.

____. 2008a. BLM NEPA Handbook (H-1790-1).

____. 2008b. BLM Manual 6840 – Special Status Species.

____. 2015. BLM Colorado Sensitive Species List. Royal Gorge Field Office.

____. 2017. Royal Gorge Field Office. *Parkdale Area Mineral Materials Sampling Environmental Assessment*. Document Reference: DOI-BLM-CO-F020-2016-0083 EA. Available online: https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage&currentPageId=128560.

____. 2018. *BLM Colorado Air Quality Report 2.0*. Colorado State Office. Available online: https://annualreport20.noobiest.repl.co/

____. 2019a. Royal Gorge Field Office BLM Sensitive Species List. Obtained from the Royal Gorge Field Office June 2019.

____. 2019b. *Colorado Rangeland Management and Grazing*. Retrieved from Rangeland Health: https://www.blm.gov/programs/natural-resources/rangeland-and-grazing/rangeland-health/colorado.

____. 2019c. *Operator Information Report.* U.S. Department of the Interior.

____. 2019d. Royal Gorge Field Office, B. (2019, August 19). Recreation Data. (ICF, Interviewer).

____. 2019e. Parkdale Quarry Expansion EIS Public Scoping Summary Report. October 10, 2019. Available online: https://eplanning.blm.gov/epl-front-office/projects/nepa/117848/20005546/250006454/PQ_EIS_Scoping_Report_2019_1010_Final.pdf

BLM Colorado State Office. 2019. August 8. Socioeconomics Information. Telephone call with BLM's Amy Stillings and ICF's Claire Munaretto on August 8, 2019.

BLS (Bureau of Labor Statistics). 2018a. Local Area Unemployment Statistics (LAUS), County Data. Retrieved from Department of Labor, Bureau of Labor Statistics: https://www.bls.gov/lau/.

____. 2018b. Quarterly Census of Employment and Wages, Table: Private, NAICS Sectors, Fremont County, Colorado, 2017 Annual Averages, All establishment sizes. September 5, 2018. Retrieved from Department of Labor, Bureau of Labor Statistics: https://data.bls.gov/cew/apps/table_maker/v4/table_maker.htm#type=6&year=2018&qtr=A&own=5&area=08043&supp=0.

____. 2019. Labor Force Statistics from the Current Population Survey: Household Data, Historical, A-1. Employment status of the civilian noninstitutional population 16 years and over, 1984 to date. September 6, 2019. Retrieved from Bureau of Labor Statistics: Labor Force Statistics from the Current Population Survey: https://www.bls.gov/web/empsit/cpseea01.htm.

Cañon City Schools. 2019. *Fremont RE-1*. Available online: https://www.canoncityschools.org.

Canterbury, C. 2016. *Fremont County Board of Commissioners resolves ambulance companies' dispute*. September 14, 2016. Retrieved from Cañon City Daily Record: https://www.canoncitydailyrecord.com/2016/09/14/fremont-county-board-of-commissioners-resolves-ambulance-companies-dispute/.

CDOT (Colorado Department of Transportation). 2018. Colorado Freight and Passenger Rail Plan. 156 pp. Available online: https://www.codot.gov/about/committees/trac/Agendas-and-Minutes/2018/july-13-2018/03-b1-sfprp-draft-final_-july-tc

CDPHE (Colorado Department of Public Health and Environment). 2018. Integrated Water Quality Monitoring and Assessment Report 2018. 519 p.

CDRMS (Colorado Division of Reclamation, Mining and Safety). 2019a. Personal communication with Mr. Cazier, Environmental Protection Specialist. October 7, 2019.

____. 2019b. *County Reports*. September 16, 2019. Available online: https://mining.state.co.us/SiteCollectionDocuments/CountyReport.pdf.

Cedar Creek (Cedar Creek Associates, Inc.). 1997. Wildlife Habitat Characterization and Utilization Report for the Parkdale Quarry Project.

Centura Health. 2019. St. Thomas More Hospital. Available online: https://www.centura.org/locations/st-thomas-more-hospital.

Colorado Department of Local Affairs. 2017a. Population Forecasts – year (2000 to 2050); 5-year increments, 2000-2050. From website Population Totals for Colorado Counties. Available online: https://demography.dola.colorado.gov/population/population-totals-counties/. Accessed March 7, 2018.

____. 2017b. Counties and Municipalities, Housing Unit and Household Estimates. Retrieved from Colorado Department of Local Affairs: https://demography.dola.colorado.gov/housing-and-households/counties-and-municipalities/#counties-and-municipalities.

____. 2018. State Demography Office Data Page: Population Projections in Colorado. June 12, 2018. Retrieved from Colorado Department of Local Affairs: https://data.colorado.gov/Demographics/Population-Projections-in-Colorado/q5vp-adf3.

Colorado Department of Revenue. 2017. *Sales and Use Tax Rates Lookup – Tax Rate Effective July to December 2017*. Retrieved from Taxation Division: https://www.colorado.gov/pacific/tax/sales-and-use-tax-rates-lookup.

Colorado Division of Water Resources (CDWR) 2020. Colorado Division of Water Resources online water rights database. Accessed online 1/3/2020 at https://data.colorado.gov/Water/DWR-Water-Right-Net-Amounts/acsg-f33s/data.

Colorado School of Mines. 2019. *Historic Mining Districts*. Retrieved from Colorado Geological Survey: http://coloradogeologicalsurvey.org/mineral-resources/historic-mining-districts/.

CPW (Colorado Parks and Wildlife). 2007. Cripple Creek DAU Mule Deer Management Plan.

____. 2019a. Statewide Game Management Unit (GMU) Map. Available online: https://cpw.state.co.us/learn/Pages/Maps.aspx. Accessed October 2019.

____. 2019b. Mule Deer Post-hunt Population Estimate Table. Available online: https://cpw.state.co.us/Documents/Hunting/BigGame/Statistics/Deer/2018DeerPopulationEstimates.pdf

____. 2019c. Bighorn Sheep Post-hunt Population Estimate Table. Available online: https://cpw.state.co.us/Documents/Hunting/BigGame/Statistics/DesertBighornSheep/2018DesertSheepPopulationEstimates.pdf

____. 2019d. Species Activity Map (SAM) Shapefile data. Available online: http://www.arcgis.com/home/group.html?id=0e6f9051b06146018038e9a929ab4910&view=list#content. Accessed September 2019.

____. 2019e. CPW Sensitive Species Profiles. Available online: https://cpw.state.co.us/learn/Pages/SpeciesProfiles.aspx

____. 2019f. Arkansas Headwaters Recreation Area Annual Report. January 28, 2019. available online: https://cpw.state.co.us/placestogo/parks/ArkansasHeadwatersRecreationArea/Documents/Annual-Reports/AnnualReport2017.pdf.

DMFPD (Deer Mountain Fire Protection District). 2019. *Deer Mountain Fire Protection District*. Available online: https://www.dmfpd.org/index.html.

DOI (U.S. Department of the Interior). 2019. *Payment in Lieu of Taxes*. Available online: https://www.doi.gov/pilt.

____. (no date). *Payment in Lieu of Taxes*. Retrieved from County Payments: https://www.nbc.gov/pilt/counties.cfm?term=county&state_code=CO&fiscal_yr=2019&Search.x=49&Search.y=13.

Domenico, P.A. and F.W. Schwartz, 1990. *Physical and Chemical Hydrogeology*, John Wiley & Sons, New York, 824 p.

EPA (Environmental Protection Agency). 2019. *Landfill Methane Outreach Program (LMOP) – Colorado*. July 2019. Available online: https://www.epa.gov/lmop/project-and-landfill-data-state.

ERM (Environmental Resource Management). 2019. Interim Hydrogeologic Assessment, Parkdale Quarry Expansion Area. 192 p.

____. 2019. *Fremont County Total Property Tax Revenue Distribution*. Available online: https://www.fremontco.com/files/assessor/taxusecharttotal.pdf.

Fremont County Finance Office. 2017. *Fremont County, Colorado Financial Statements*. December 31, 2017. Available online: https://www.fremontco.com/files/administration/finance/2017audit.pdf.

Fremont County Planning Commission. 2015. *Fremont County Master Plan, 2015 Update.* Fremont County. Available online: https://www.fremontco.com/files/planning-and-zoning/masterplan2015.pdf.

Fremont County Treasurer's Office. Receipt of Tax Payment. Colorado, USA. April 29, 2019.

George, J.L., Kahn, R., Miller, M.W., Watkins, B. 2009. Colorado Division of Wildlife, Colorado Bighorn Sheep Management Plan 2009-2019.

Google. 2019. *Google Maps*. Available online: https://www.google.com/maps.

Headwaters Economics. 2019. A Profile of Industries that Include Travel and Tourism. Fremont County, CO. Available online: https://headwaterseconomics.org/tools/economic-profile-system/.

ICF. 2019. Biological Field Survey of the Proposed And Alternative Mineral Materials Sale Area Draft Report. October 2019.

IPCC (Intergovernmental Panel on Climate Change). 2013. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Jansen B.D., Krausman, P.R., Heffelfinger, J.R., and J.C. DeVos Jr. 2007. Influence of mining on behavior of bighorn sheep. Southwestern Naturalist. 52:418–423.

MacCallum, N.B. 1988. Seasonal and spatial distribution of bighorn sheep at an open pit mine in the Alberta foothills. Biennial Symposium Northern Wild Sheep and Goat Council 6:106–120.

____. 1991. Bighorn sheep use of an open pit coal mine in the foothills of Alberta. Master's Degree Project. Faculty of Environmental Design, University of Calgary. 202pp..

Marcus, N., Woods, S., Simmons, S. 2011. Colorado State Forest Service Pinyon-Juniper Management Quick Guide.

Martin Marietta (Martin Marietta Materials, Inc.). 2016. Proposed Parkdale Quarry Mining and Reclamation Plan. No Date. 30 pp.

____. 2017. Parkdale Quarry BLM Expansion Project Rationale. May 1, 2017. *Parkdale Quarry BLM Expansion Project Rationale, Information from Martin Marrieta*.

____. 2019a. Modified Mineral Materials Sale Area Design Specifications. Via email from David Bieber to BLM.

____. 2019b. Parkdale EIS Air RFI Responses, August 7, 2019. (ICF, Interviewer)

____. 2019c. Employees' county of residence. Telephone call with Martin Marietta's David Bieber and ICF's economist on August 22, 2019.

____. 2019d. Parkdale Quarry Coordination Meeting, August 7, 2019. (ICF, Interviewer)

____. 2019e. Socioeconomics Interview. Conference call with Martin Marietta's David Bieber and ICF's economist on October 14, 2019.

Natural Resource Conservation Service (NCRS). 2020. Web Soil Survey Report; Parkdale Quarry. Accessed online at: https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

Resource Economics LLC. 2019. *Economic Impact of Proposed Parkdale Quarry Project*. Prepared by Resource Economics. Boulder, Colorado. July 18, 2019. 22 pp.

Royal Gorge Route Railroad. 2017. *Royal Gorge History*. Retrieved from Royal Gorge Route Railroad: https://royalgorgeroute.com/about-us/history/.

SCEDD (Southern Colorado Economic Development District). 2017. Fremont County. Available online: https://www.scedd.com/economic-development/2017-draft-ceds/.

Spitz, K. and J Moreno, 1996. A Practical Guide to Groundwater and Solute Transport Modeling, John Wiley & Sons, New York, 461 p.

State of Colorado. 2019a. *Florence, Colorado Water Department*. Retrieved from Colorado Official State Web Portal: https://www.colorado.gov/pacific/florencecolorado/water-department-1.

____. 2019b. *Florence Colorado Police Department.* Available online: https://www.colorado.gov/pacific/florencecolorado/about-department.

____. 2019c. *Cañon City Area Fire Protection District*. Available online: https://www.colorado.gov/pacific/canoncityfire.

____. 2019d. *Fremont County, Colorado*. Available online: https://www.colorado.gov/pacific/townofbrookside/fremont-county-colorado.

USCB (U.S Census Bureau). 2000. American Factfinder: Table DP-1: Profile of General Demographic Characteristics: 2000, Census 2000 Summary File 1. Retrieved from United States Census Bureau, Population Divison: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_00_SF1_DP1&prodType=table.

____. 2010a. American Factfinder: Table DP-1: Profile of General Population and Housing Characteristics: 2010, 2010 Census. Retrieved from United States Census Bureau, 2010 Census: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_DP_DPDP1&prodType=table.

____. 2010b. American Factfinder: Table DP03: Selected Economic Characteristics, 2006-2010 American Community Survey 5-Year Estimates. Retrieved from United States Census Bureau: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_10_5YR_DP03&prodType=table.

____. 2017a. American Factfinder: TAble DP03: Selected Economic Characteristics, 2013-2017 American Community Survey 5-Year Estimates. Retrieved from United States Census Bureau, 2013-2017 American Community Survey 5-Year Estimates: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_17_5YR_DP03&prodType=table.

____. 2017b. American Factfinder: Table DP05: ACS Demographic and Housing Estimates, 2013-2017 American Community Survey 5-Year Estimates. Retrieved from United States Census Bureau, 2013-2017 American Community Survey 5-year Estimates: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_17_5YR_DP05&prodType=table.

____. 2017c. Poverty Thresholds. Available online: https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html.

____. 2017d. American Factfinder: Table B25004: Vacancy Status, Universe: Vacant housing units, 2013-2017 American Community Survey 5-year Estimates. Retrieved from United States Census Bureau, 2013-2017 American Community Survey 5-Year Estimates: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_17_5YR_B25004&prodType=table.

____. 2017e. American Factfinder: Table DP04: Selected Housing Characteristics, 2006-2010 American Community Survey 5-year Estimates. Retrieved from United States Census Bureau, 2006-2010 American Community Survey: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_17_5YR_DP04&prodType=table.

____. 2017f. American Factfinder: Table CP04: Comparative Housing Characteristics, 2013-2017 American Community Survey 5-year Estimates. Retrieved from United States Census Bureau, 2013-2017 American Community Survey 5-Year Estimates: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_17_5YR_CP04&prodType=table.

____. 2019. American FactFinder: Table PEPANNRES: Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2018. April 2019. Retrieved from United States Census Bureau, Population Division: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=PEP_2018_PEPANNRES&prodType=table.

USFWS (U.S. Fish and Wildlife Service). 2019a. National Wetlands Inventory. Available online: https://www.fws.gov/wetlands/index.html.

____. 2019b. Colorado Ecological Field Services Office, Denver Colorado. Section 7 Species Consultation Letter for the Parkdale Quarry Expansion. Received July 10, 2019.

USGS (U.S. Geological Survey). 2018. A new generation of the United States National Land Cover Database—Requirements, research priorities, design, and implementation strategies: ISPRS Journal of Photogrammetry and Remote Sensing. Yang, L., Jin, S., Danielson, P., Homer, C.G., Gass, L., Bender, S.M., Case, A., Costello, C., Dewitz, J.A., Fry, J.A., Funk, M., Granneman, B.J., Liknes, G.C., Rigge, M.B., and G. Xian. Volume 146, p. 108–123, Available online: https://doi.org/10.1016/j.isprsjprs.2018.09.006.

____. 2019. National Hydrology Dataset (NHD). Available online: https://www.usgs.gov/core-science-systems/ngp/national-hydrography.

Whetstone Associates. 2019. Drawdown Scoping Analysis - Parkdale EIs. December 15, 2019.

Whetstone Associates. 2020. Runoff Modeling, Parkdale Quarry Project. January 15, 2020.

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# *Appendix B*

Glossary and Index

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# APPENDIX B GLOSSARY AND INDEX

**Acre:** A unit of land measure equal to 43,560 square feet.

**Affecting:** Will or may have an effect on.

**Allotment:** A unit of land suitable and available for livestock grazing that is managed as one grazing unit.

**Alluvium:** A general term for clay, silt, sand, gravel, or similar unconsolidated detrital material, deposited during comparatively recent geologic time by a stream or other body of running water.

**Animal Unit Month (AUM):** The amount of forage required by one cow and calf, or their equivalent, for one month.

**Aquifer:** A zone, stratum, or group of strata acting as a hydraulic unit that stores or transmits water in sufficient quantities for beneficial use.

**Bedrock:** Solid rock exposed at the surface of the earth or overlain by unconsolidated material, weathered rock, or soil.

**Best Management Practices (BMPs):** Methods that have been determined to be the most effective and practical means of preventing or reducing impacts on a resource.

**Borehole:** A hole with a drill, auger, or other tools for exploring strata in search of minerals, for water supply, for blasting purposes, for proving the position of old workings and faults, and for releasing accumulations of gas or water.

**Cooperating Agency:** Any federal agency other than a lead agency which has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major federal action significantly affecting the quality of the human environment. The selection and responsibilities of a cooperating agency are described in Section 1501.6. A State or local agency of similar qualifications or, when the effects are on a reservation, an Indian Tribe, may by agreement with the lead agency become a cooperating agency.

**Cultural Resources:** Archaeological sites, architectural structures or features, traditional use areas, and Native American sacred sites or special use areas.

**Cumulative Impact:** The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

**Deposit:** A natural accumulation, such as precious metals, minerals, coal, gas, oil, etc., that may be pursued for its intrinsic value; gold deposit.

**Dewatering:** The lowering of the water level in a well as a result of withdrawal; the reduction in groundwater level at a point caused by the withdrawal of water from an aquifer.

**Drawdown:** Vertical distance that a water elevation is lowered or the pressure head is reduced due to the removal of water from the same system.

**Effects** include:

(a) Direct effects, which are caused by the action and occur at the same time and place.

(b) Indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

Effects and impacts as used in these regulations are synonymous. Effects includes ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects also may include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial.

**Erosion:** The wearing away of the land surface by running water, wind, ice or other geologic agents, including such processes as gravitation creep.

**Exploration:** The search for economic deposits of minerals, ore, gas, oil, or coal through the practices of geology, geochemistry, geophysics, drilling, shaft sinking and/or mapping.

**Extraction:** The process of mining and removal of coal or ore from a mine. Also used in relation to all process of obtaining metals from ores.

**Feasible:** Capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors.

**Federal Agency:** All agencies of the Federal Government. It does not mean the Congress, the Judiciary, or the President, including the performance of staff functions for the President in his Executive Office. For the purposes of regulation it includes States and units of general local government and Indian tribes assuming NEPA responsibilities under section 104(h) of the Housing and Community Development Act of 1974.

**Forage:** All browse and non-woody plants that are available to livestock or game animals for grazing or harvestable for feed.

**Greenhouse Gas (GHG):** An atmospheric gas such as water vapor, carbon dioxide, methane, and ozone that absorbs and emits radiation.

**Groundwater:** Water found beneath the land surface in the zone of saturation below the water table.

**Growth Media:** All materials, including topsoil, specified soil horizons, vegetative debris, and organic matter, which are classified as suitable for stockpiling and/or reclamation.

**Haul Road:** A road used by large (<50-ton capacity) trucks to haul ore and waste rock from an open pit mine to other locations.

**Hydraulic Conductivity:** The capacity of a rock to transmit water. It is expressed as the volume of water at the existing kinematic viscosity that will move in unit time under a unit hydraulic gradient through a unit area measured at right angles to the direction of flow.

**Key Observation Point (KOP):** A specific place on a travel route or within an existing or potential use area where the view of a management activity or project would be most revealing for purposes of the contrast rating.

**Lead Agency:** The agency or agencies preparing or having taken primary responsibility for preparing the environmental impact statement.

**Mine Pit:** Surface area from which ore and waste rock are removed.

**Mining Claim:** A portion of the Public Domain or related lands which a miner, for mining purposes, takes and holds in accordance with mining laws.

**Mitigation** includes:

(a) Avoiding the impact altogether by not taking a certain action or parts of an action.

(b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation.

(c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.

(d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.

(e) Compensating for the impact by replacing or providing substitute resources or environments.

**Monitor:** To systematically and repeatably watch, observe, or measure environmental conditions in order to track changes.

**National Ambient Air Quality Standards (NAAQS):** The Clean Air Act requires the U.S. Environmental Protection Agency (EPA) to set NAAQS for pollutants that are considered harmful to the public and environment. These pollutants come from numerous and diverse sources. The EPA has set NAAQS for six principal pollutants, which are called “criteria” pollutants:

- Carbon monoxide
- Lead
- Nitrogen oxides

- Particulate matter
    - $PM_{10}$ (any particulate matter with a diameter less than or equal to 10 microns)
    - $PM_{2.5}$ (any particulate matter with a diameter less than or equal to 2.5 microns. Also called “fine particulate matter”)
- Ozone
- Sulfur dioxide

The Clean Air Act established two types of NAAQS:

1) **Primary standards:** set limits to protect public health, including the health of “sensitive” populations such as asthmatics, children, and the elderly.
2) **Secondary standards:** set limits to protect public welfare, including protection against visibility impairment, damage to animals, crops, vegetation, and buildings.

**NEPA Process:** All measures necessary for compliance with the requirements of section 2 and Title I of the National Environmental Policy Act (NEPA).

**Notice of Intent:** A notice that an environmental impact statement will be prepared and considered. The notice shall briefly:

(a) Describe the proposed action and possible alternatives.

(b) Describe the agency's proposed scoping process including whether, when, and where any scoping meeting will be held.

(c) State the name and address of a person within the agency who can answer questions about the proposed action and the environmental impact statement.

“Proposal” exists at that stage in the development of an action when an agency subject to the Act has a goal and is actively preparing to make a decision on one or more alternative means of accomplishing that goal and the effects can be meaningfully evaluated. Preparation of an environmental impact statement on a proposal should be timed (Section 1502.5) so that the final statement may be completed in time for the statement to be included in any recommendation or report on the proposal. A proposal may exist in fact as well as by agency declaration that one exists.

**Permeability:** see hydraulic conductivity.

**pH:** Symbol for the negative common logarithm of the hydrogen ion concentration (acidity) of a solution. The pH value of 7 is considered neutral. A pH value below 7 indicates acidity, and a pH value above 7 indicates alkalinity or a base.

**Plan of Operations:** A detailed description presenting the methods, timing, and contingencies to be used during the operation of the Project. A document required from any person proposing to conduct mineral related activities which utilize earth moving equipment and which will cause disturbance to surface resources.

**Reclamation:** Returning disturbed land to a form and productivity in conformity with a predetermined land management plan or a government approved plan or permit.

**Record of Decision:** A document separate from but associated with an Environmental Impact Statement which states the decision; identifies all alternatives, specifying which were environmentally preferable; and states whether all practicable means to avoid environmental harm from the alternative have been adopted, and if not, why not (40 CFR 1505.2).

**Right-of-way:** Strip of land or corridor over which a powerline, pipeline, access road, or maintenance road would pass.

**Riparian:** Pertaining to or situated on the bank of a body of water, especially of a watercourse such as a river.

**Scope:** Consists of the range of actions, alternatives, and impacts to be considered in an environmental impact statement. The scope of an individual statement may depend on its relationships to other statements (Sections1502.20 and 1508.28). To determine the scope of environmental impact statements, agencies shall consider three types of actions, three types of alternatives, and three types of impacts. They include:

(a) Actions (other than unconnected single actions) which may be:

Connected actions, which means that they are closely related and therefore should be discussed in the same impact statement. Actions are connected if they:

(i) Automatically trigger other actions which may require environmental impact statements.

(ii) Cannot or will not proceed unless other actions are taken previously or simultaneously.

(iii) Are interdependent parts of a larger action and depend on the larger action for their Justification.

Cumulative actions, which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement.

Similar actions, which when viewed with other reasonably foreseeable or proposed agency actions, have similarities that provide a basis for evaluating their environmental consequences together, such as common timing or geography. An agency may wish to analyze these actions in the same impact statement. It should do so when the best way to assess adequately the combined impacts of similar actions or reasonable alternatives to such actions is to treat them in a single impact statement.

(b) Alternatives, which include: No Action Alternative.

  - Other reasonable courses of actions.
  - Mitigation measures (not in the Proposed Action).

(c) Impacts, which may be: 1) direct; 2) indirect; 3) cumulative.

**Sensitive Species:** Those species designated by a BLM State Director, in cooperation with a State agency responsible for managing the species, as sensitive. Sensitive species are those species (1) under status review by the U.S. Fish and Wildlife Service/National Marine Fisheries Service; (2) whose numbers are declining so rapidly that Federal listing may become necessary; (3) with typically small and widely dispersed populations; or (4) inhabiting ecological refugia or other specialized or unique habitats.

**Stockpile:** An accumulation of ore, stone, or other mined or quarried material.

**Surface Water:** Water found in ponds, lakes, inland seas, streams, and rivers or above the ground surface.

**Watershed:** The entire land area that contributes water to a particular drainage system or stream.

**Wilderness Area:** Wilderness areas are designated by Congress under the authority of the Wilderness Act of 1964 and comprise the National Wilderness Preservation System.

**Winter Range:** Important habitat and forage area for big game, as it provides valuable food and thermal cover that allow ungulate species (specifically mule deer for this analysis) to conserve energy during severe winter weather conditions.

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# *Appendix C*

Draft EIS Figures

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Figure 3.9-1. Socioeconomic Study Area
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Figure 3.9-3. Fremont Historic Mining Districts

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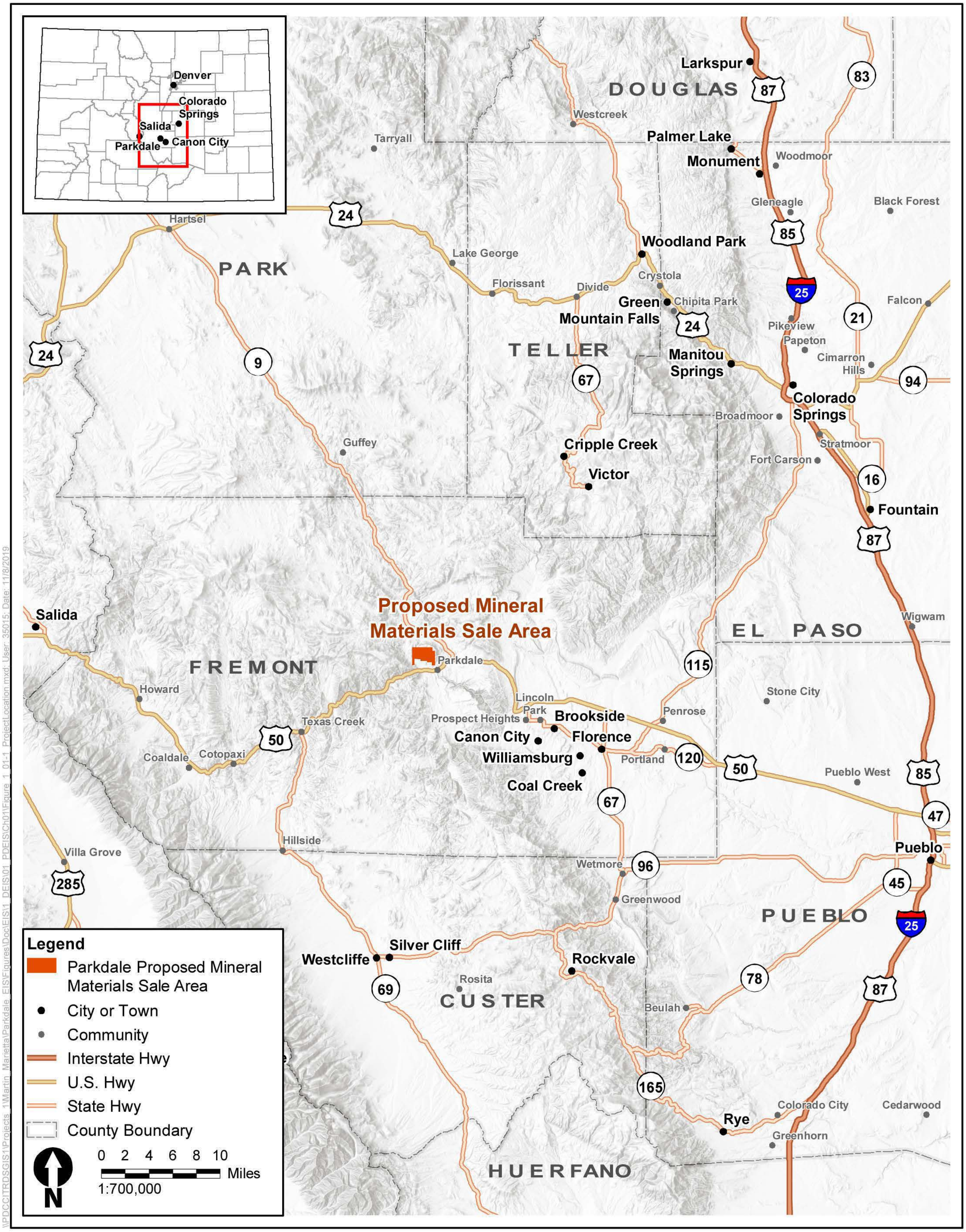

Figure 1.1-1
Proposed Quarry Location

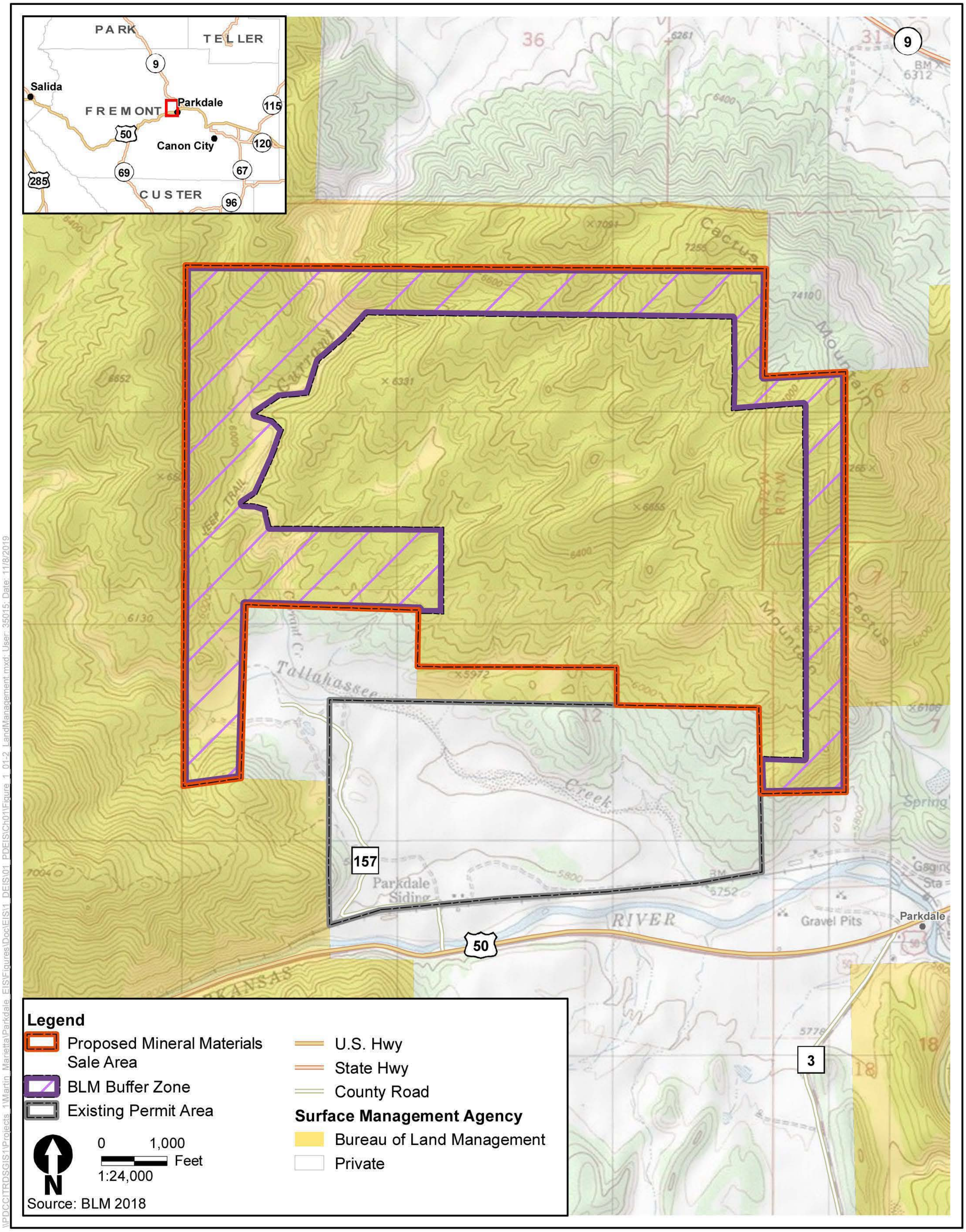

**Figure 1.1-2**
**Land Management Status within the Existing Quarry and Proposed Mineral Materials Sale Area**

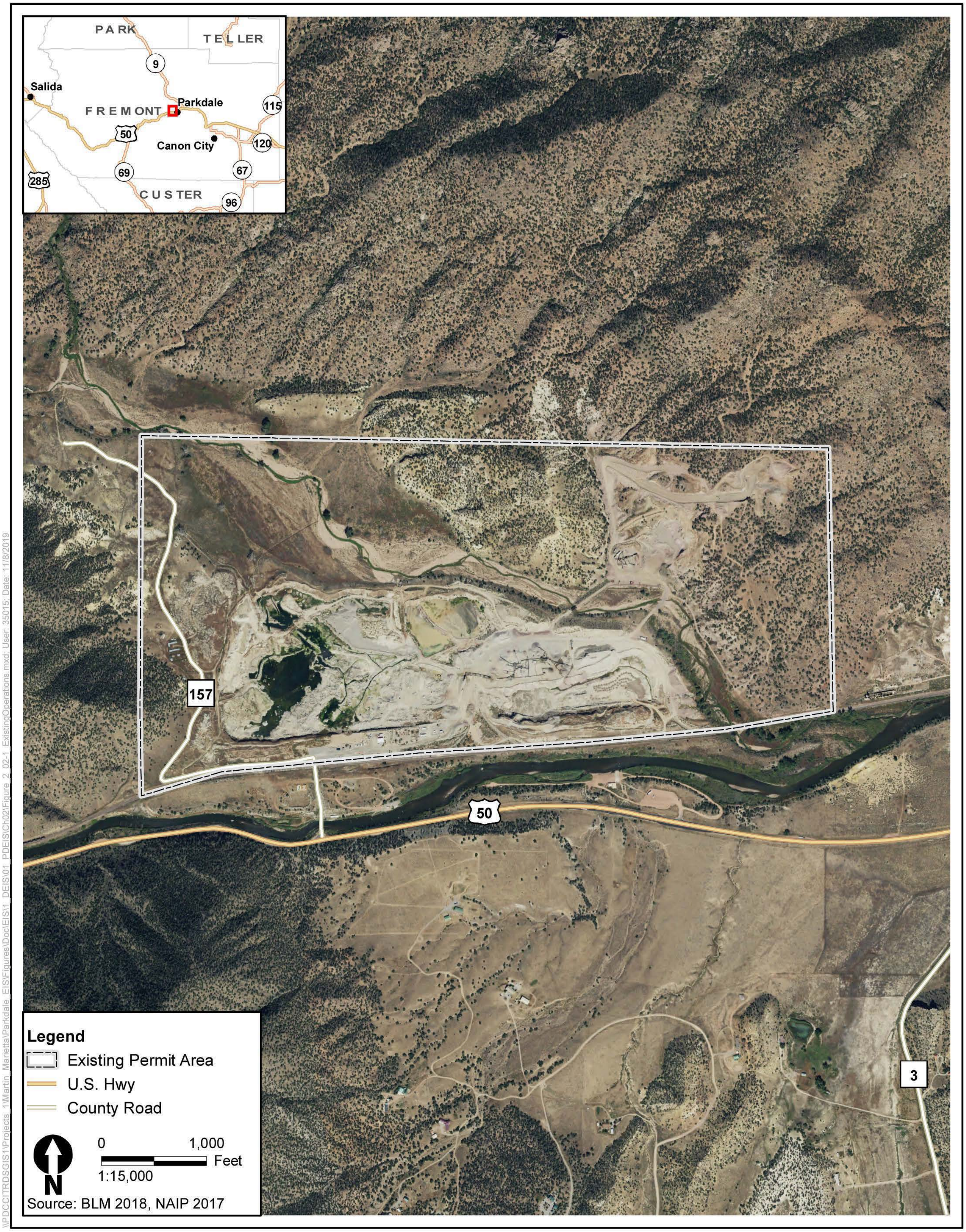

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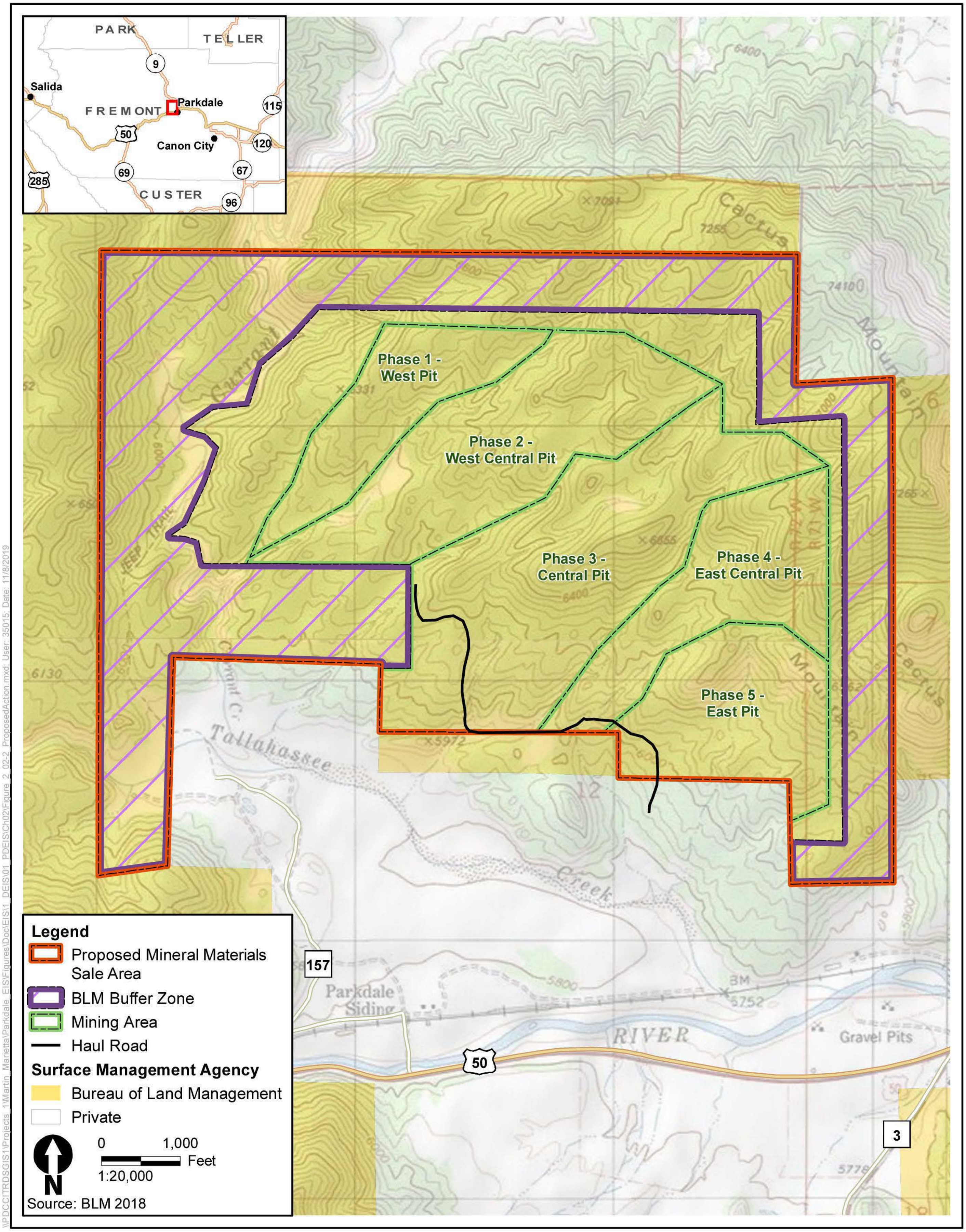
**Figure 2.2-1**
**Existing Operations**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TELLER
9
Salida
Parkdale
FREMONT
115
50
Canon City
120
285
69
67
CUSTER
96
Phase 1 - West Pit
Phase 2 - West Central Pit
Phase 3 - Central Pit
Phase 4 - East Central Pit
Phase 5 - East Pit
Cactus Mountain
Carrant
JEEP TRAIL
Tallahassee Creek
157
Parkdale Siding
RIVER
50
Gravel Pits
3
Legend
Proposed Mineral Materials Sale Area
BLM Buffer Zone
Mining Area
Haul Road
Surface Management Agency
Bureau of Land Management
Private
N
0
1,000
Feet
1:20,000
Source: BLM 2018
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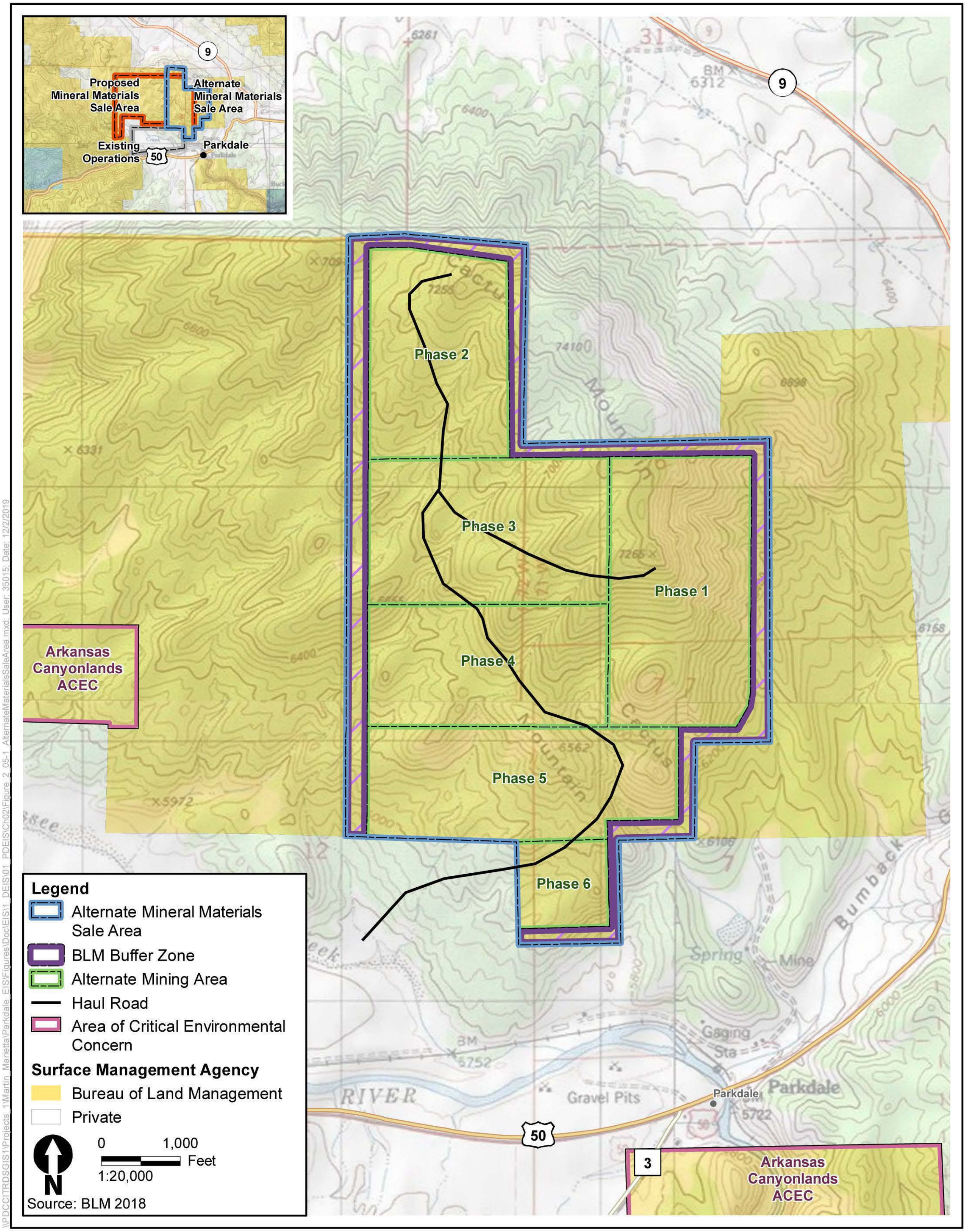
**Figure 2.2-2**
**Proposed Mineral Materials Sale Area**



Source: BLM 2018

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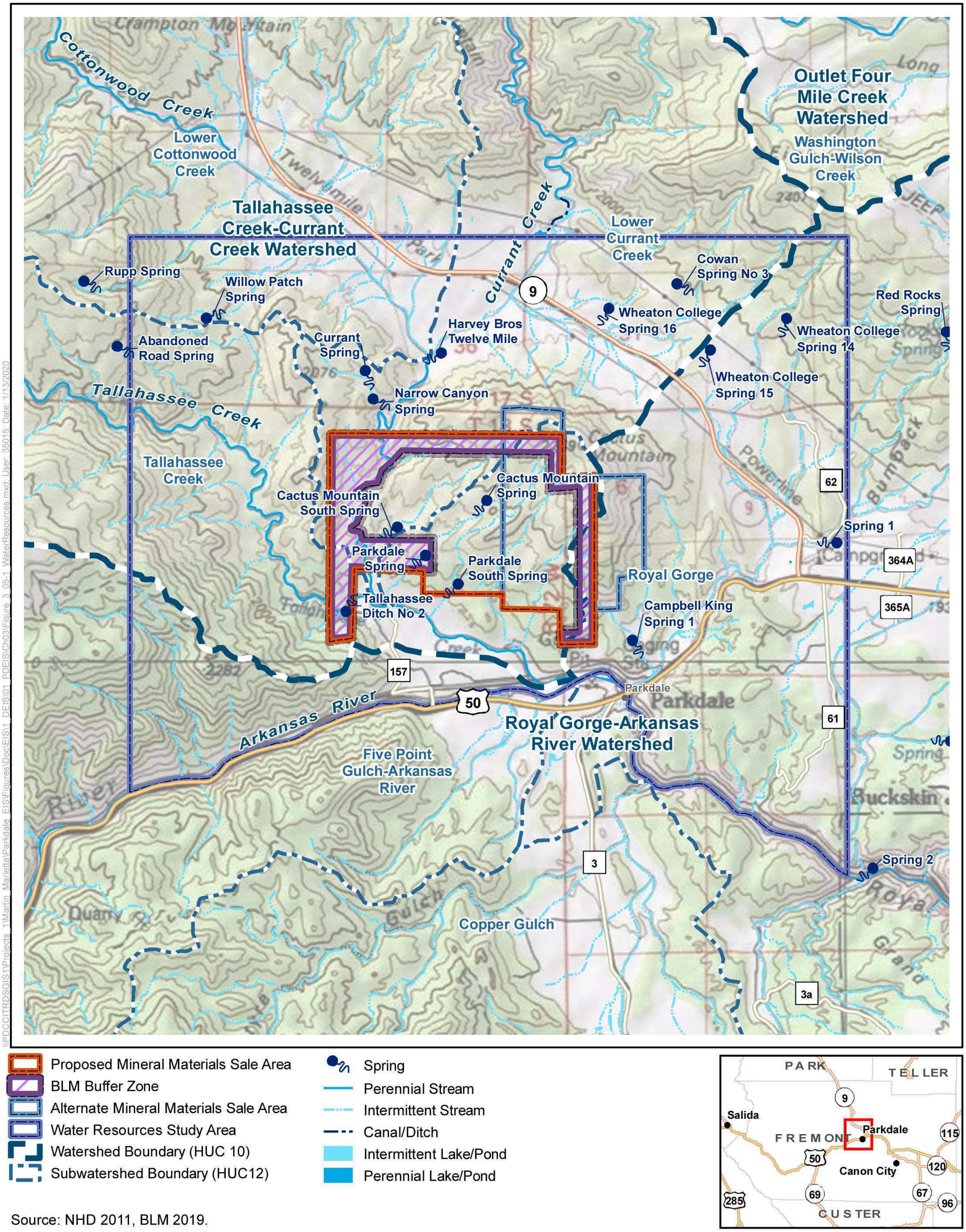
Figure 2.5-1
Alternate Mineral Materials Sale Area



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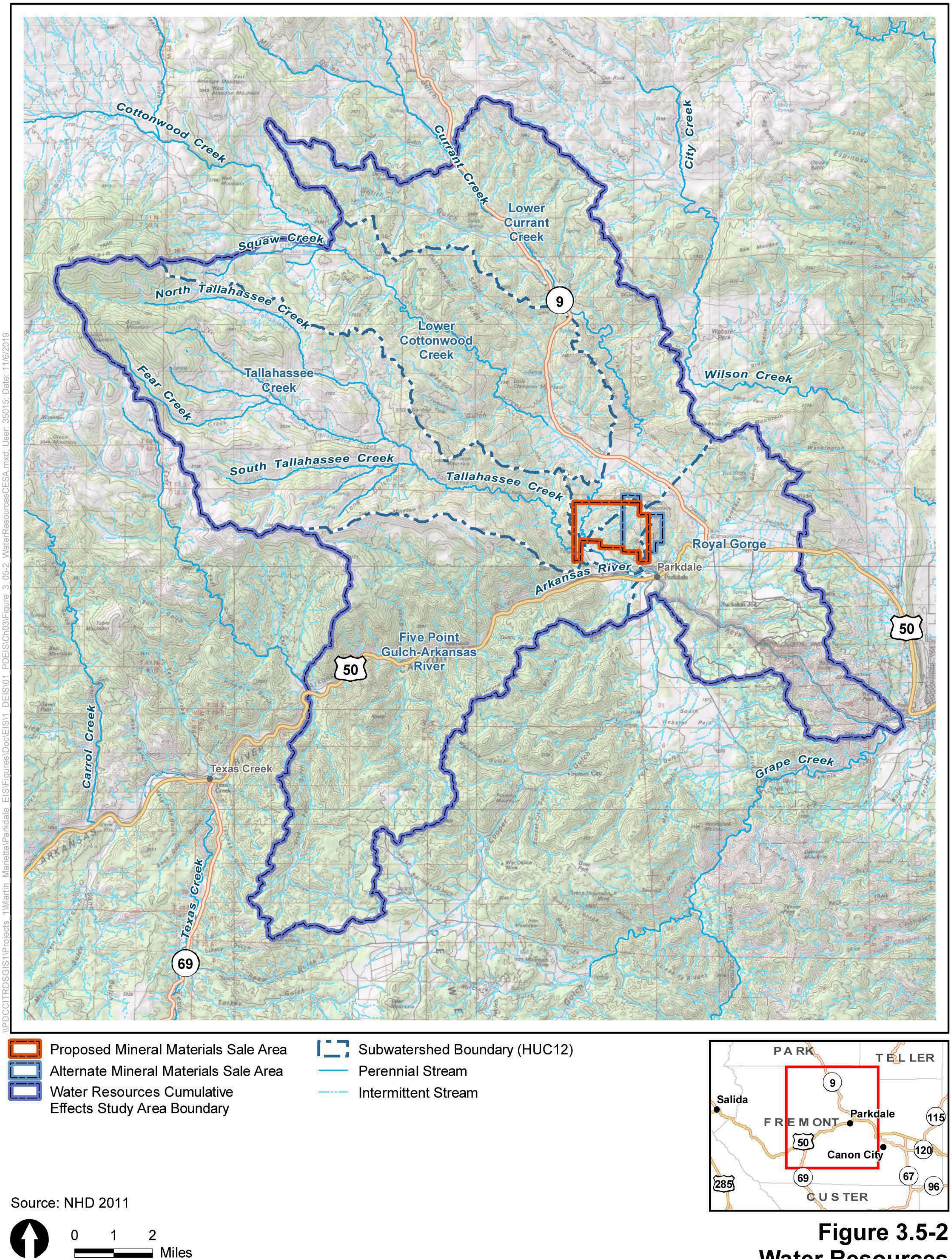
Source: NHD 2011, BLM 2019.

N

0 0.5 1 Miles

1:60,000

**Figure 3.5-1**
**Water Resources Analysis Area for Direct and Indirect Effects**



Source: NHD 2011

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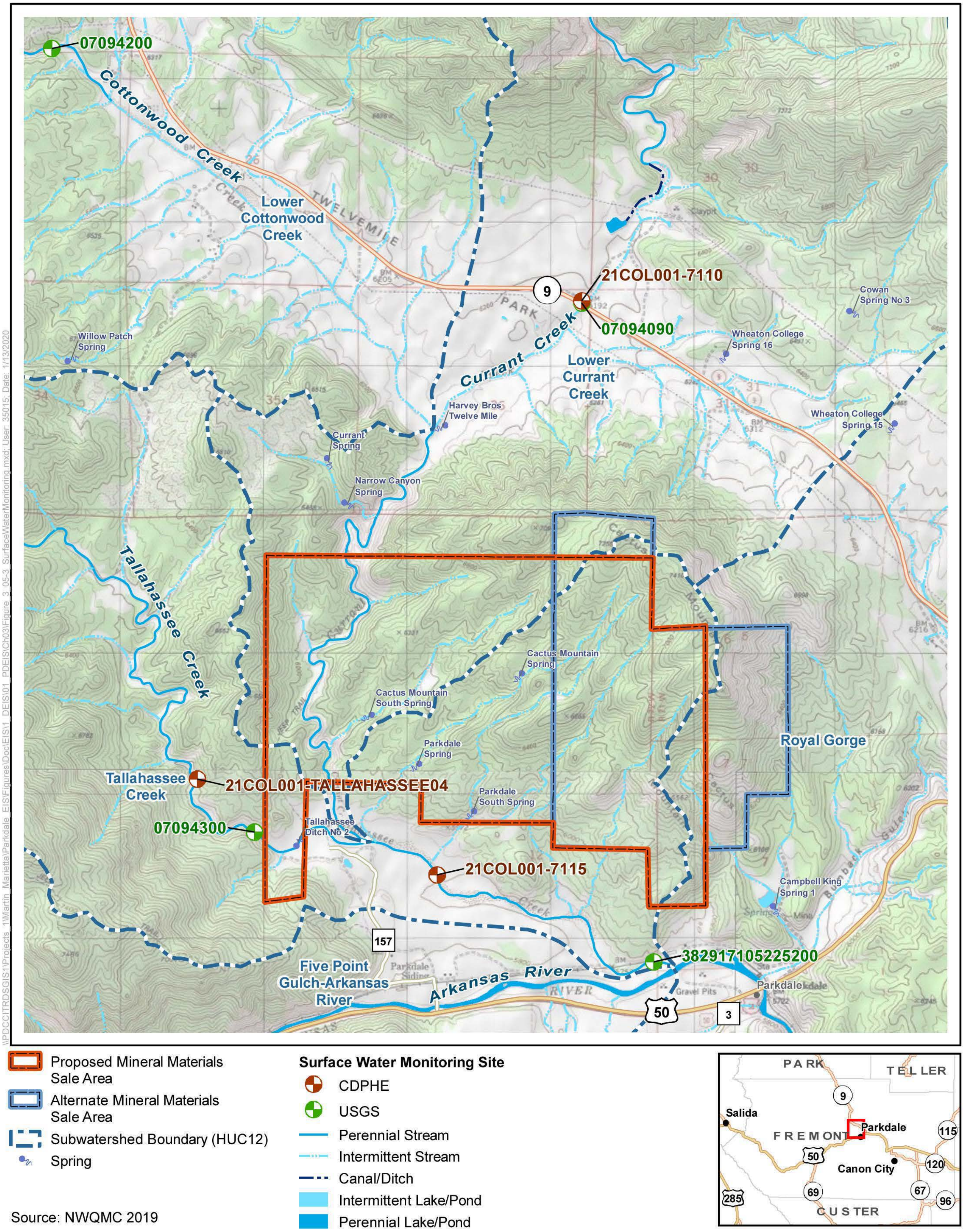
0 1 2 Miles

1:210,000

## Figure 3.5-2
## Water Resources
## Cumulative Effects Study Area

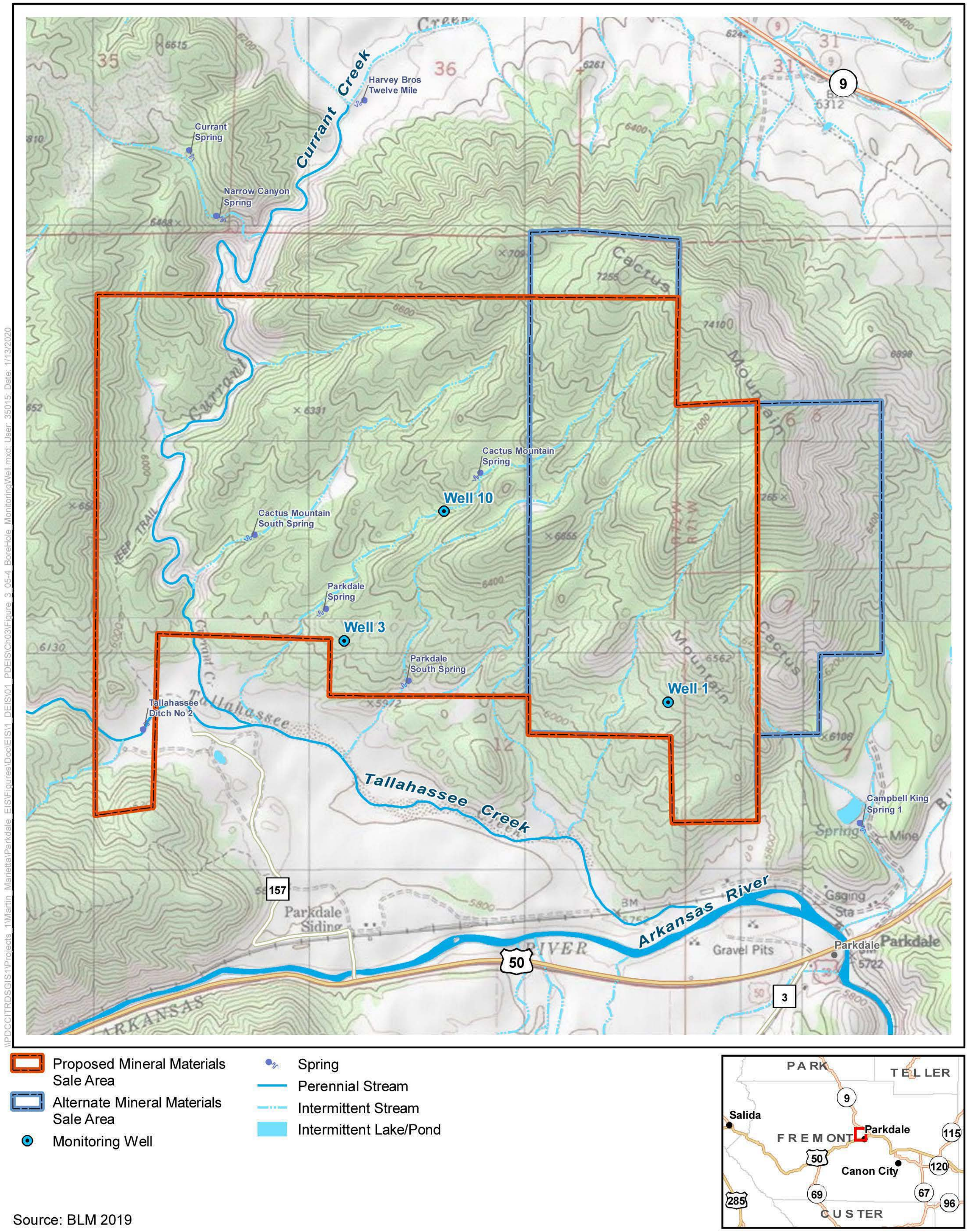
\\PDCCITRDSGIS1\Projects_1\Martin_Marietta\Parkdale_EIS\Figures\Doc\EIS\1_DEIS\01_PDEIS\Ch03\Figure_3_05-2_WaterResourcesCESA.mxd User: 35015; Date: 11/6/2019



Source: NWQMC 2019

\\PDCCITRDSGIS1\Projects_1\Martin_Marietta\Parkdale_EIS\Figures\Doc\EIS\1_DEIS\01_PDEIS\Ch03\Figure_3_05-3_SurfaceWaterMonitoring.mxd; User: 35015; Date: 1/13/2020

Figure 3.5-3
USGS and CDPHE Surface Water Monitoring Locations



Source: BLM 2019

N

0 0.25 0.5 Miles

1:24,000

## Figure 3.5-4
## Monitoring Well Locations within the Mineral Sale Area

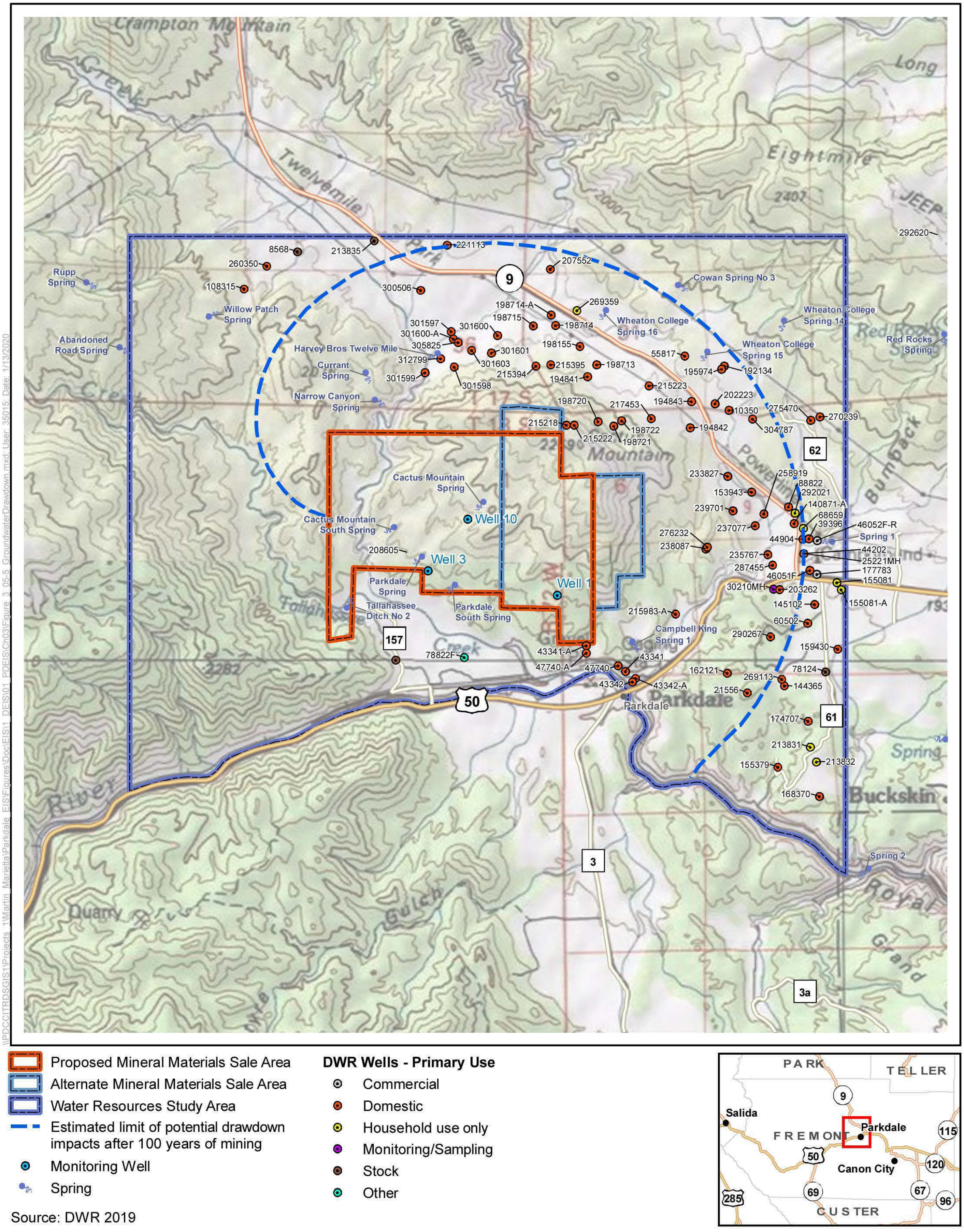
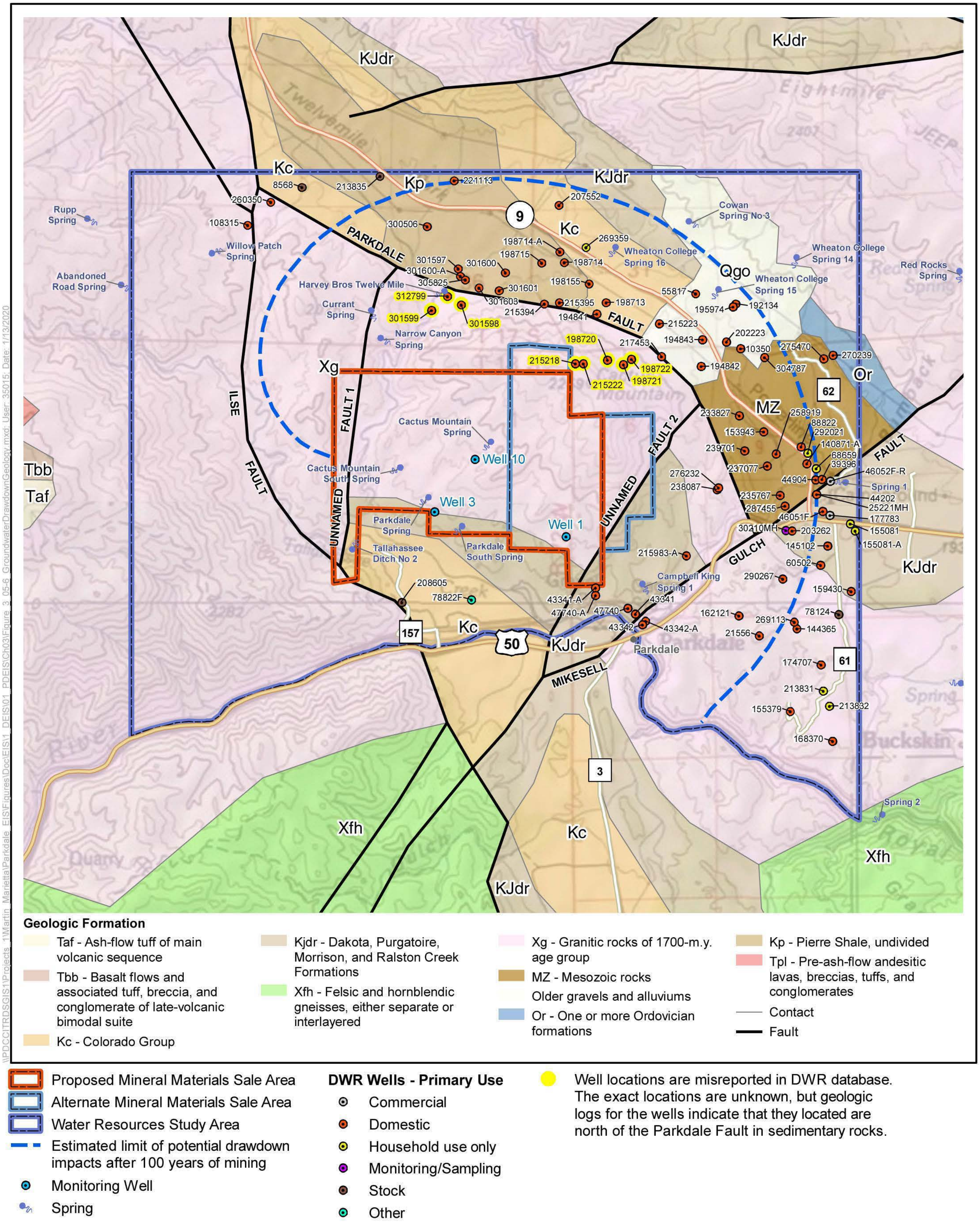
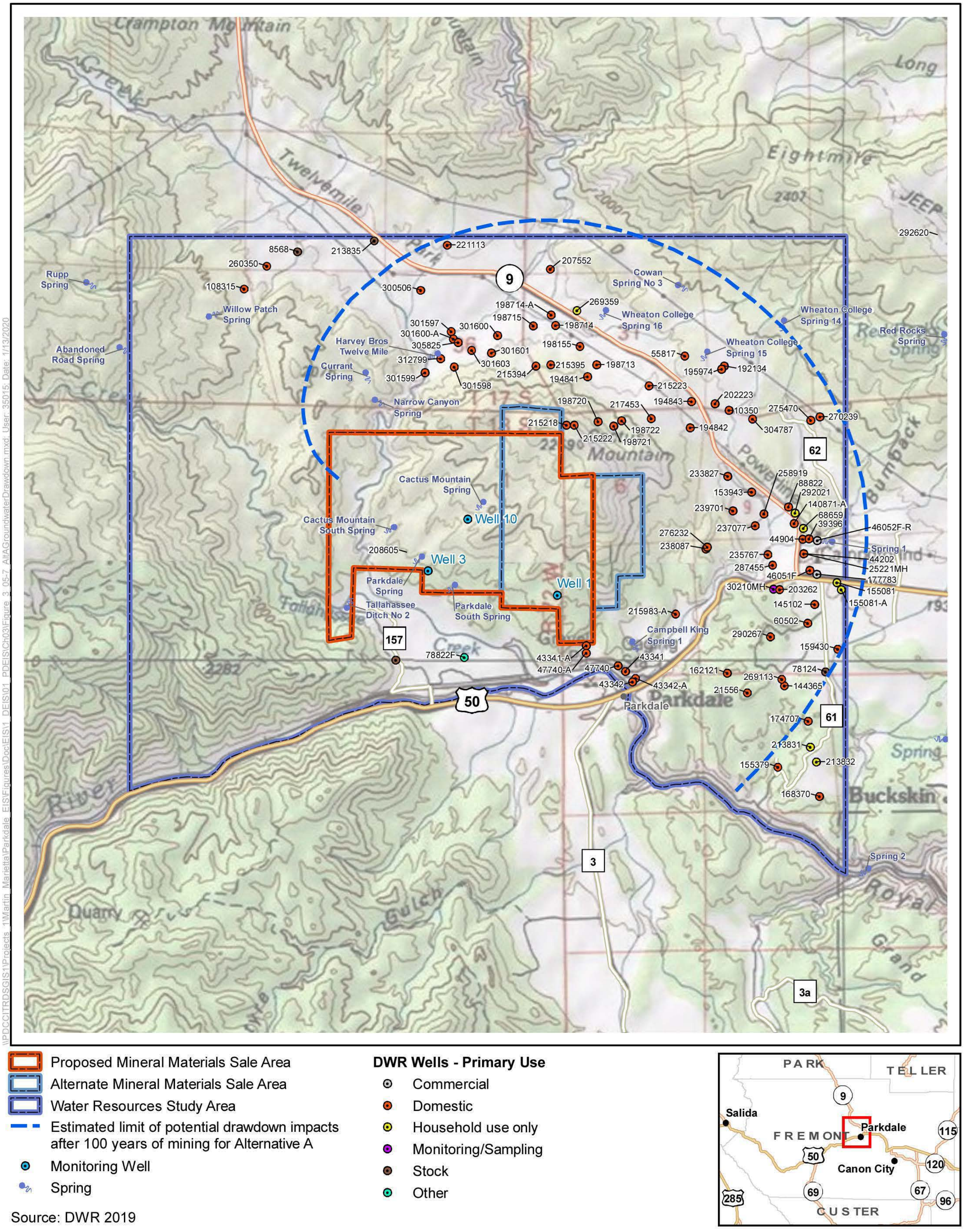


**Figure 3.5-5**
**Groundwater Users and Well Locations within the Water Resources Study Area**



Source: DWR 2019, Green 1992.

Figure 3.5-6
Geologic Setting of Groundwater Wells within the Water Resources Study Area



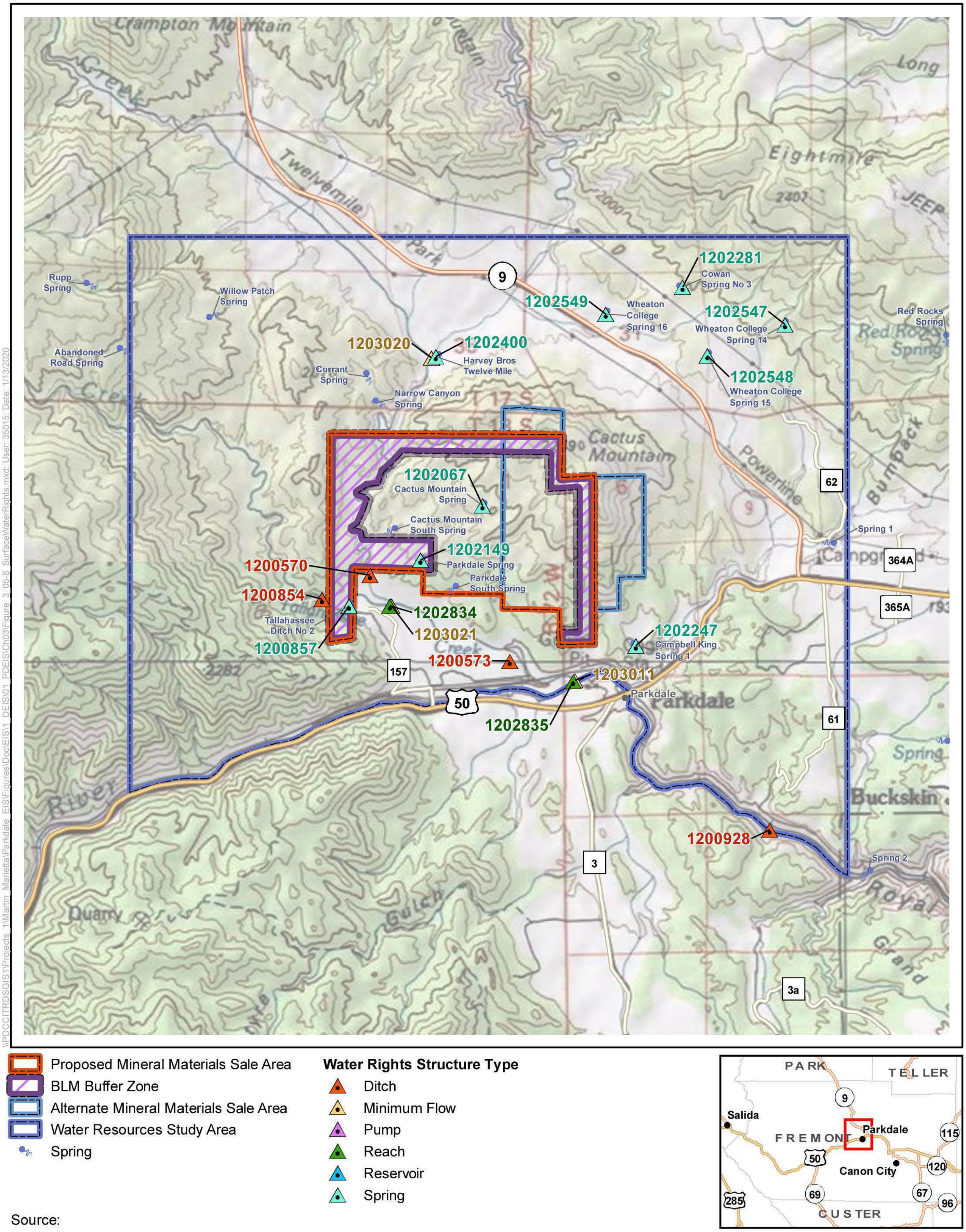
▭ Proposed Mineral Materials Sale Area
▭ Alternate Mineral Materials Sale Area
▭ Water Resources Study Area
– – Estimated limit of potential drawdown impacts after 100 years of mining for Alternative A
● Monitoring Well
● Spring

**DWR Wells - Primary Use**

● Commercial
● Domestic
● Household use only
● Monitoring/Sampling
● Stock
● Other

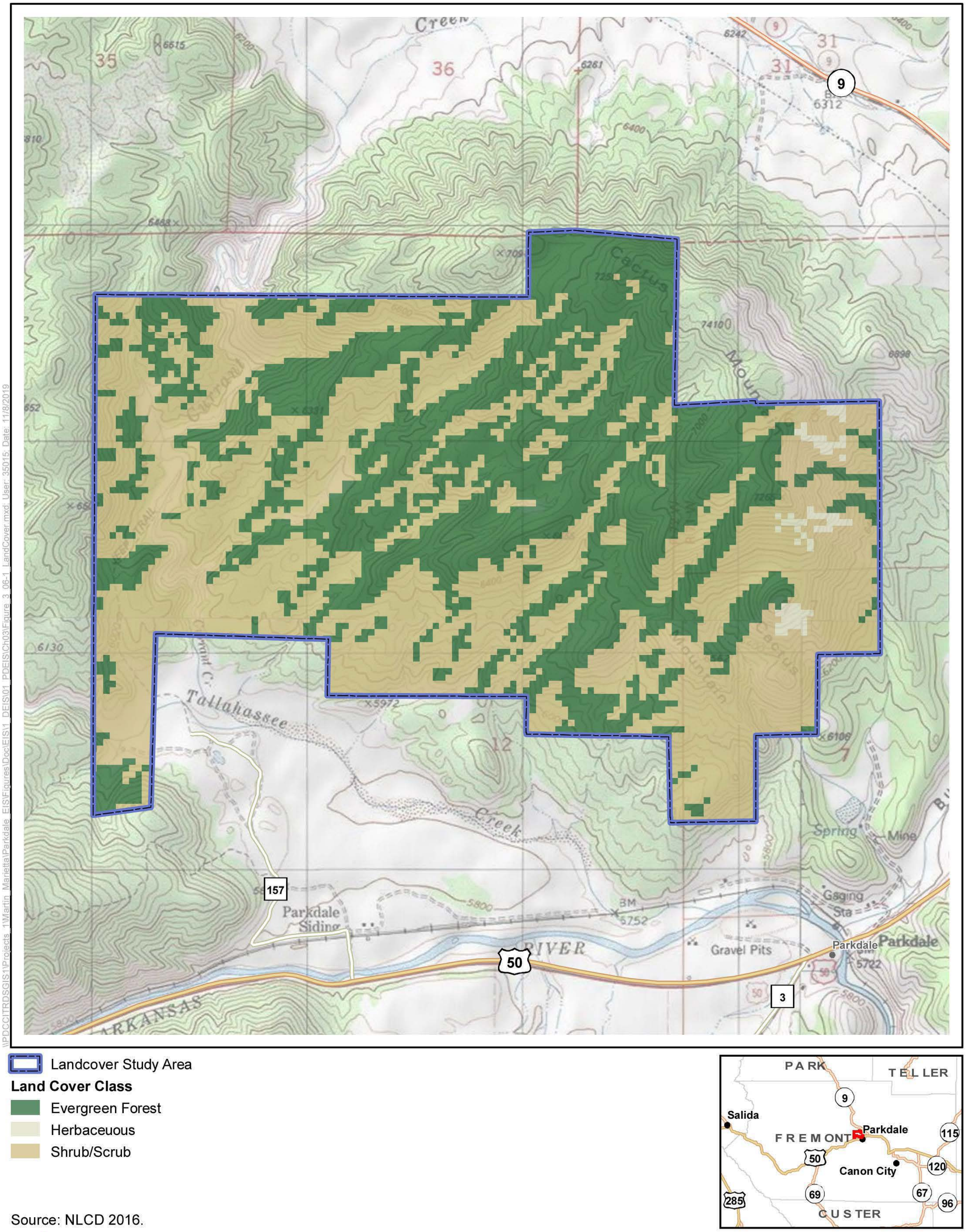
Source: DWR 2019

## Figure 3.5-7
## Area of Potential Groundwater Drawdown Impacts for Alternative A



Source:

**Figure 3.5-8**
**Surface Water Rights in the Water Resources Study Area**



▭ Landcover Study Area

**Land Cover Class**

🟩 Evergreen Forest

▭ Herbaceuous

🟨 Shrub/Scrub

Source: NLCD 2016.

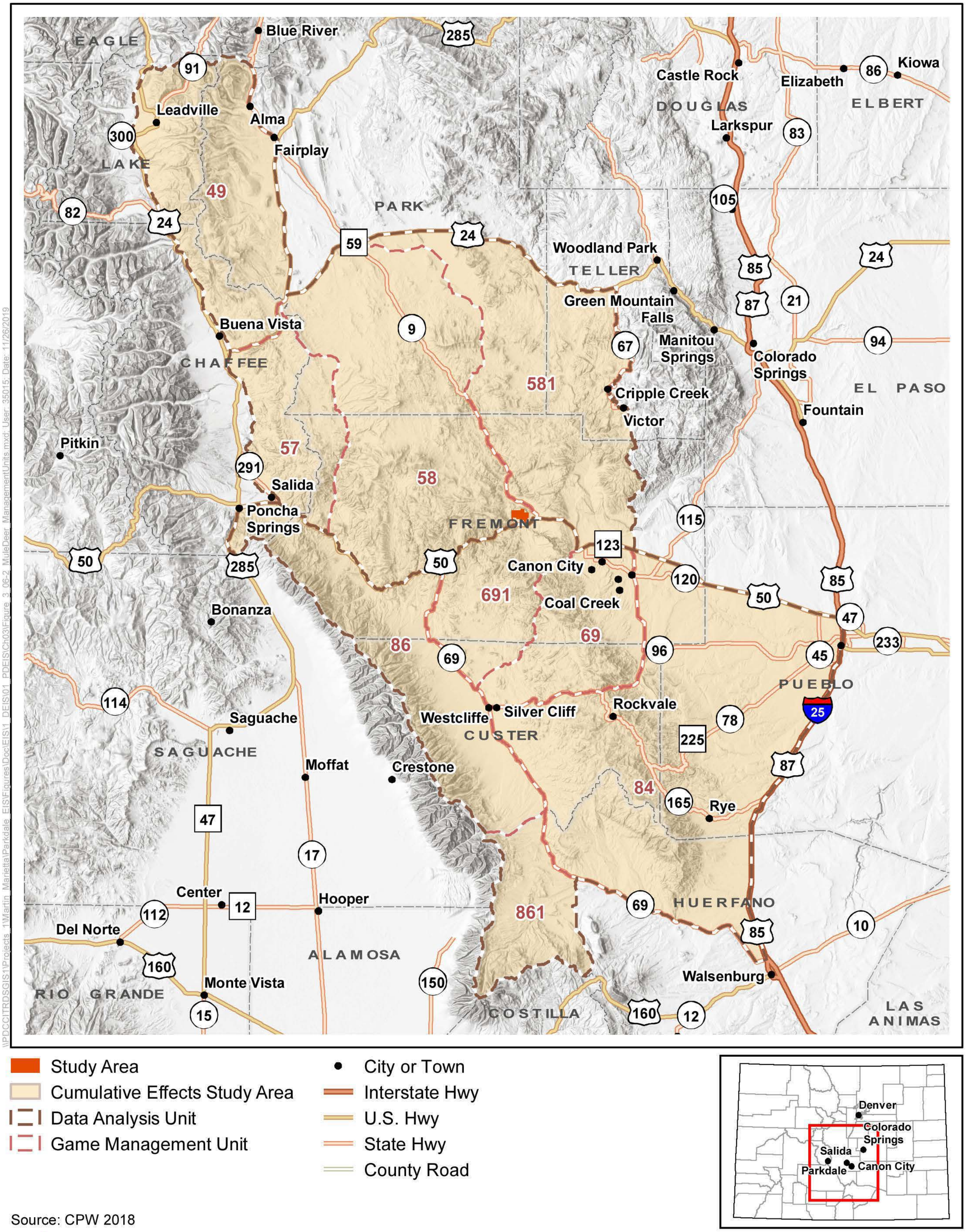
N

0 0.25 0.5 Miles

1:24,000

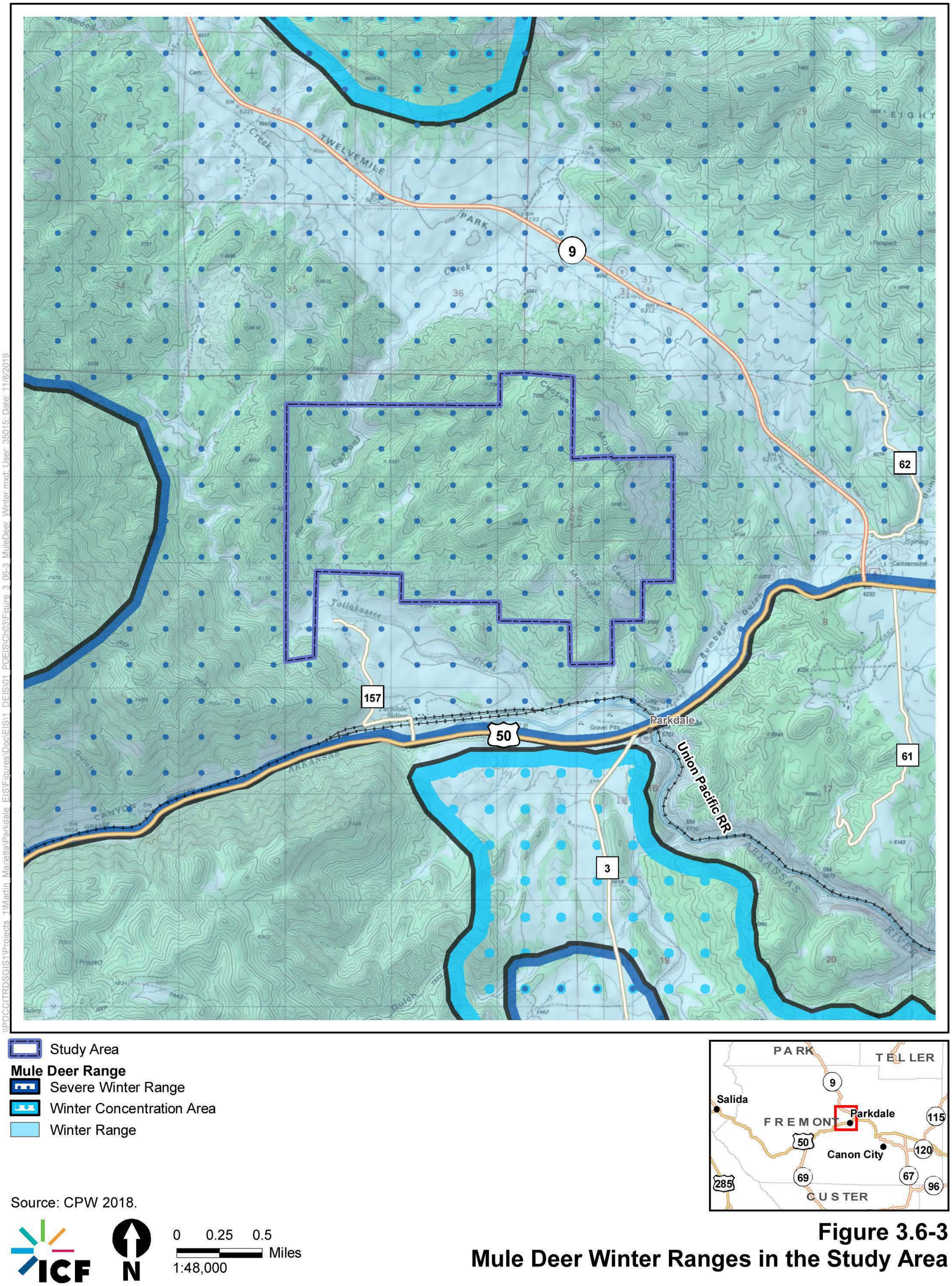
## Figure 3.6-1
## Landcover in the Study Area

\\PDCCITRDSGIS1\Projects_1\Martin_Marietta\Parkdale_EIS\Figures\Doc\EIS\1_DEIS\01_PDEIS\Ch03\Figure_3_06-1_LandCover.mxd; User: 35015; Date: 11/8/2019



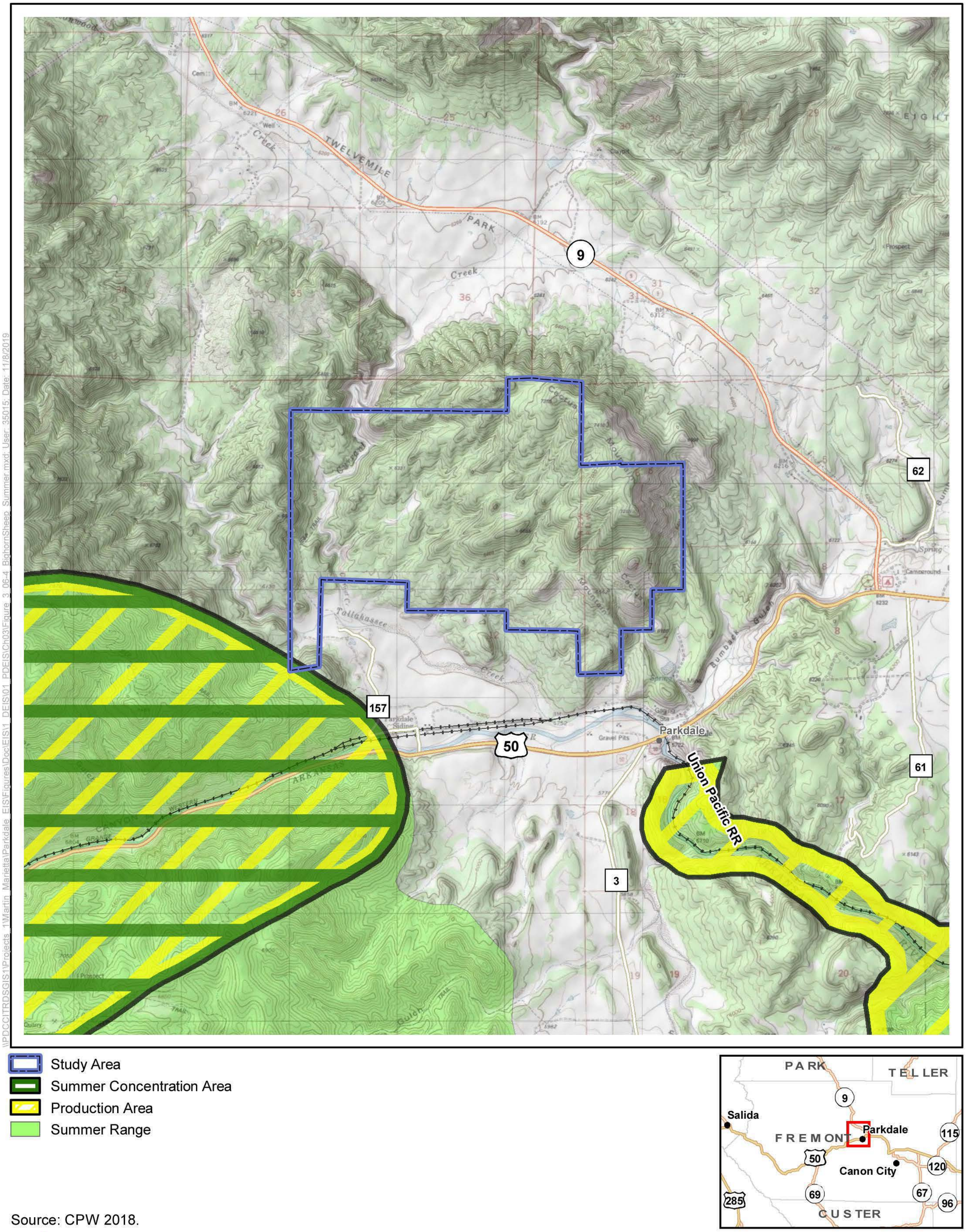
Source: CPW 2018

**Figure 3.6-2**
**Mule Deer Cumulative Effects Study Area**



Source: CPW 2018.

Figure 3.6-3
Mule Deer Winter Ranges in the Study Area



\\PDCCITRDSGIS1\Projects_1\Martin_Marietta\Parkdale_EIS\Figures\Doc\EIS\1_DEIS\01_PDEIS\Ch03\Figure_3_06-4_BighornSheep_Summer.mxd; User: 35015; Date: 11/8/2019

- ▭ Study Area
- ▭ Summer Concentration Area
- ▨ Production Area
- 🟩 Summer Range

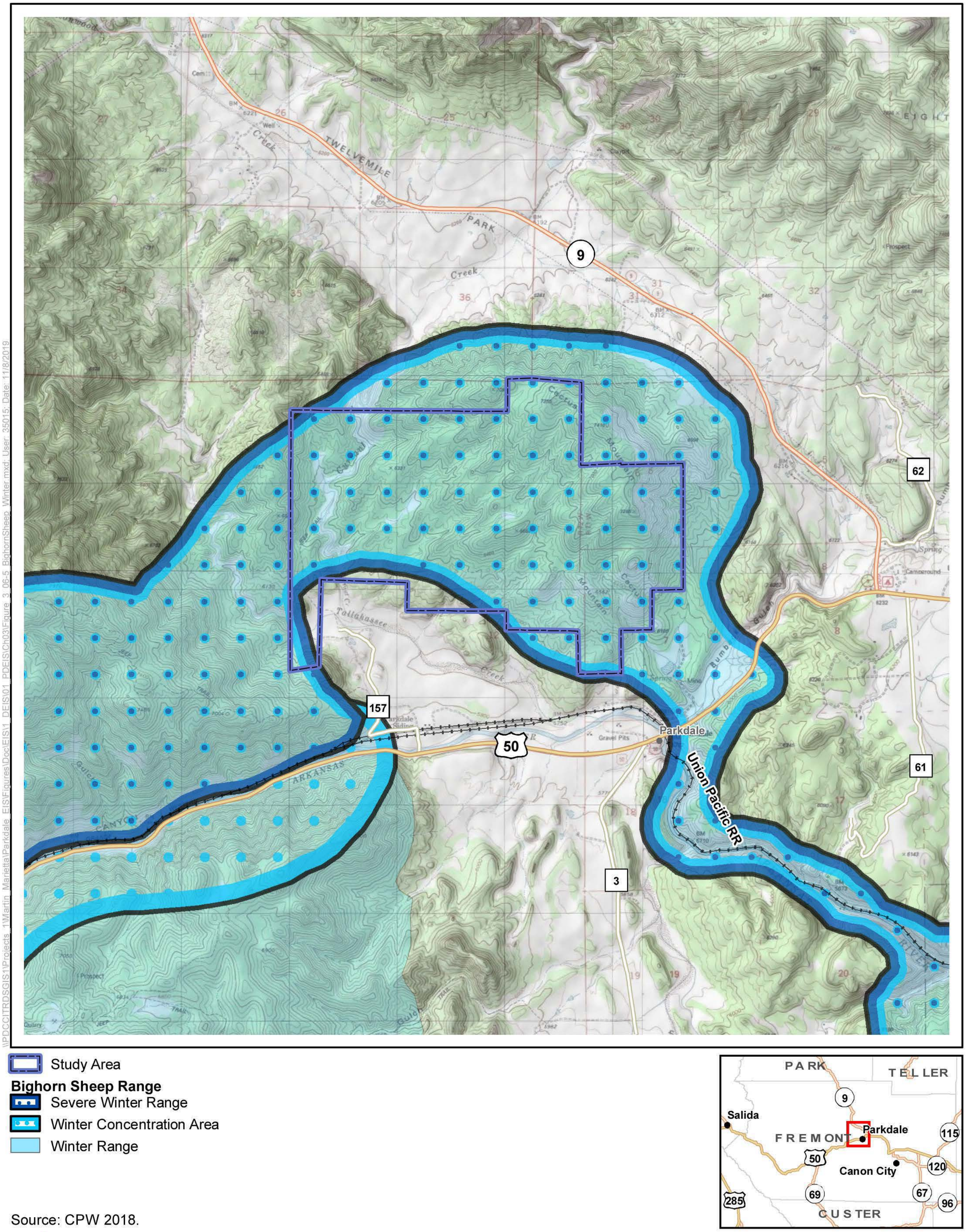
Source: CPW 2018.

N

0 0.25 0.5 Miles

1:48,000

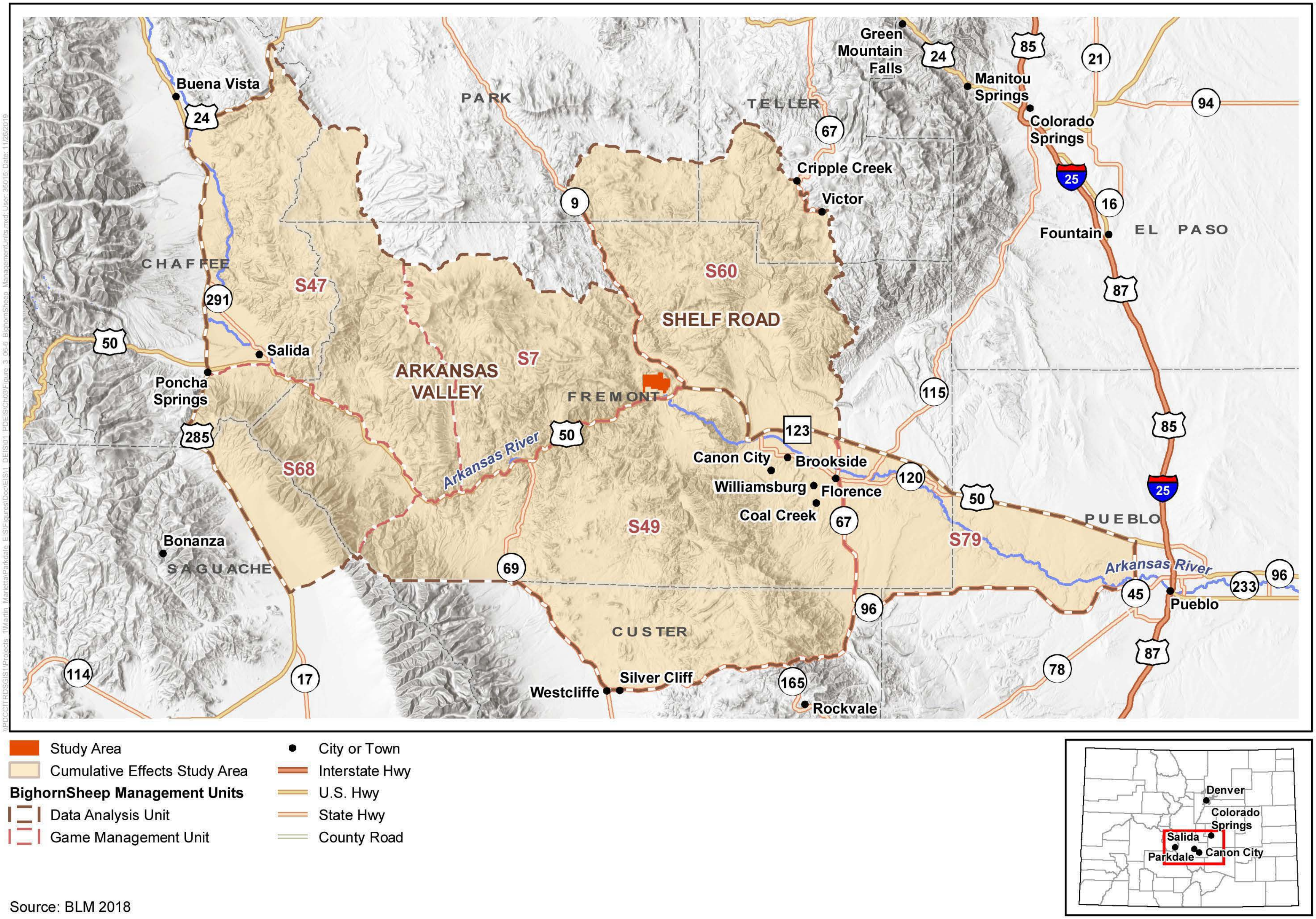
## Figure 3.6-4
## Bighorn Sheep Summer Ranges in the Study Area



\\PDCCITRDSGIS1\Projects_1\Martin_Marietta\Parkdale_EIS\Figures\Doc\EIS\01_PDEIS\Ch03\Figure_3_06-5_BighornSheep_Winter.mxd; User: 35015; Date: 11/8/2019

Source: CPW 2018.

Figure 3.6-5
Bighorn Sheep Winter Ranges in the Study Area

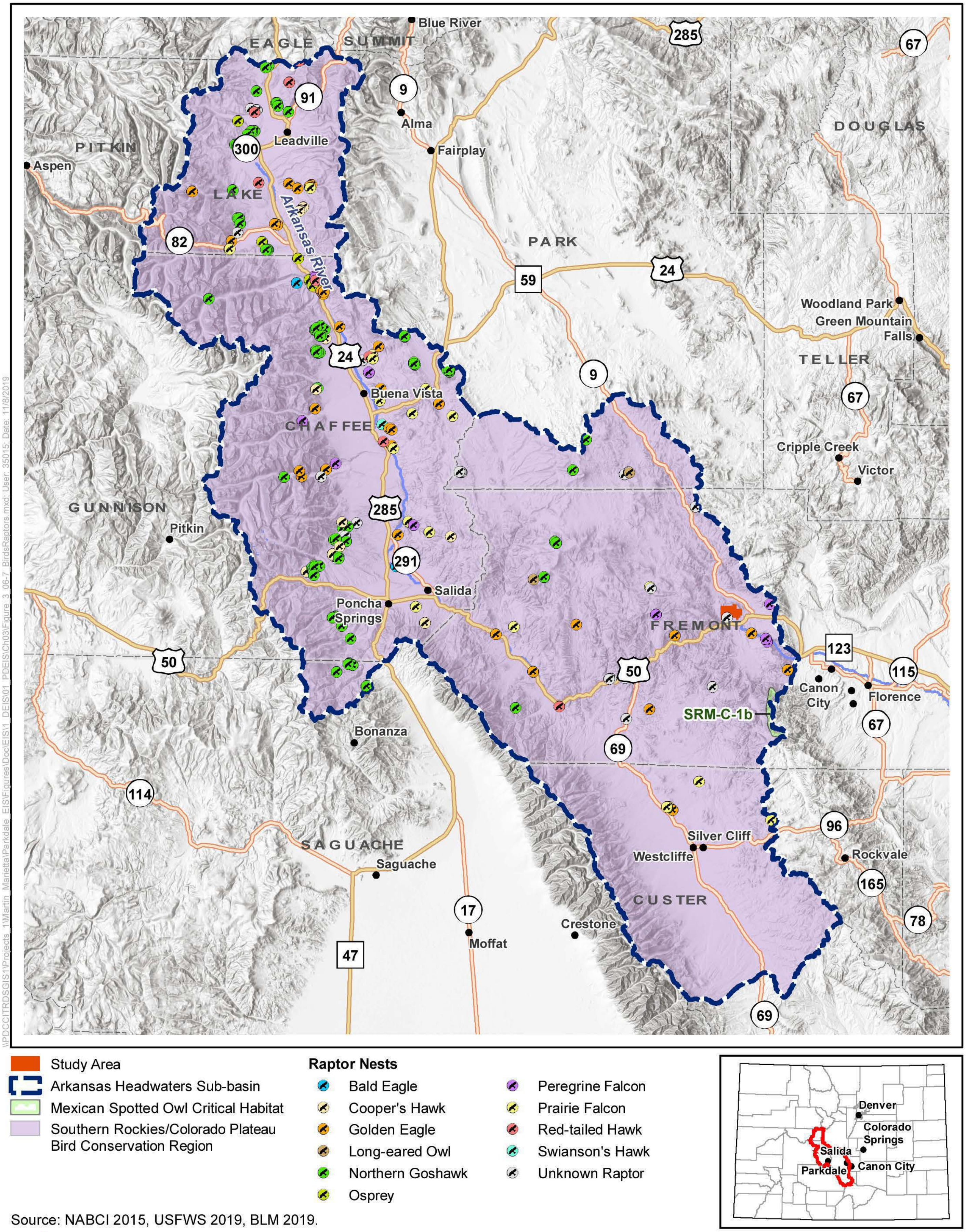


Source: BLM 2018

0 5 10 Miles
1:700,000

N

## Figure 3.6-6
## Bighorn Sheep Cumulative Effects Study Area



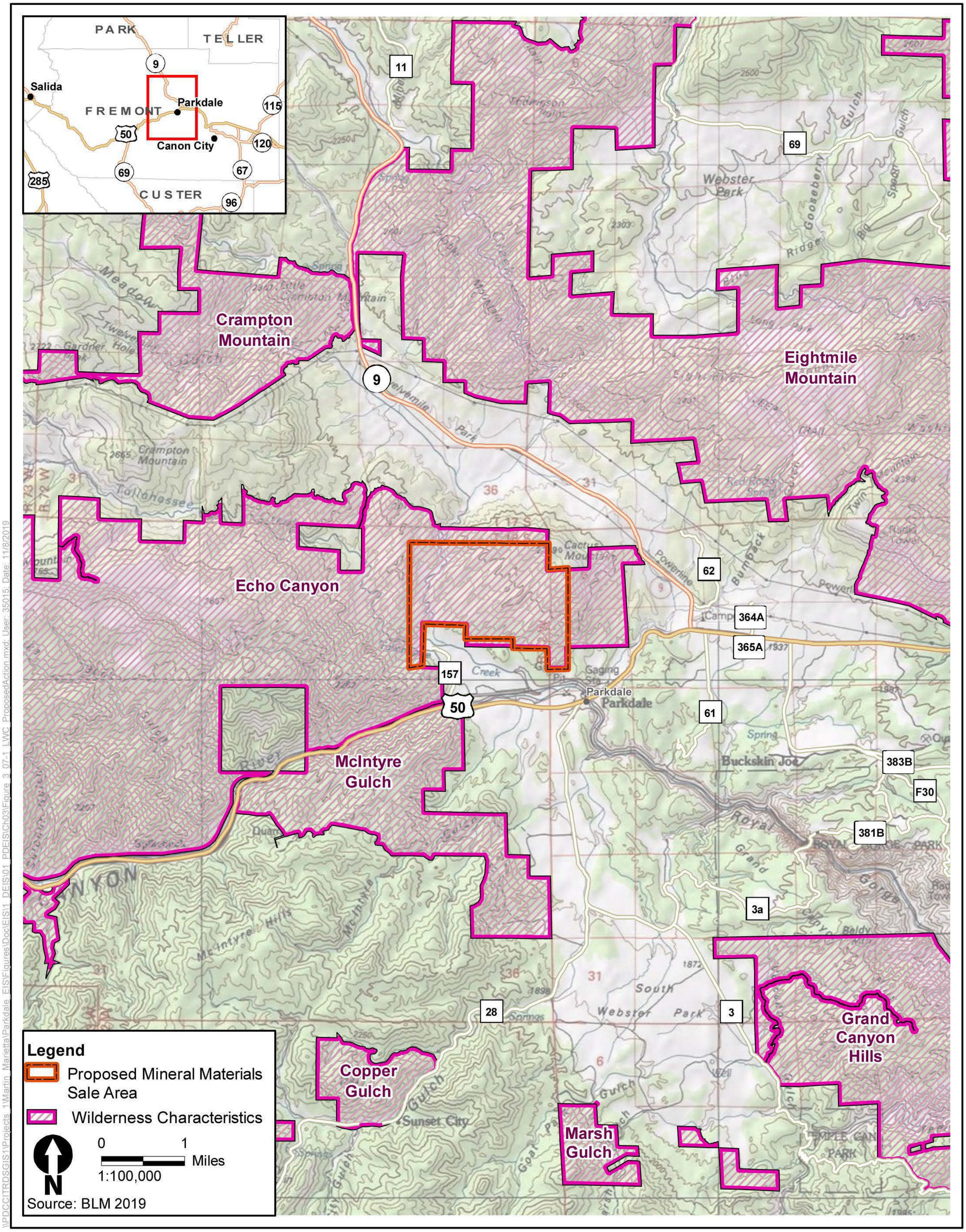
Source: NABCI 2015, USFWS 2019, BLM 2019.

0 5 10
Miles
1:900,000

N

ICF

**Figure 3.6-7**
**Migratory Birds/Raptors**
**Cumulative Effects Study Area**



\\PDCCITRDSGIS1\Projects_1\Martin_Marietta\Parkdale_EIS\Figures\Doc\EIS\1_DEIS\01_PDEIS\Ch03\Figure_3_07-1_LWC_ProposedAction.mxd; User: 35015; Date: 11/8/2019

Figure 3.7-1
Proposed Mineral Materials Sale Area and Lands with Wilderness Characteristics

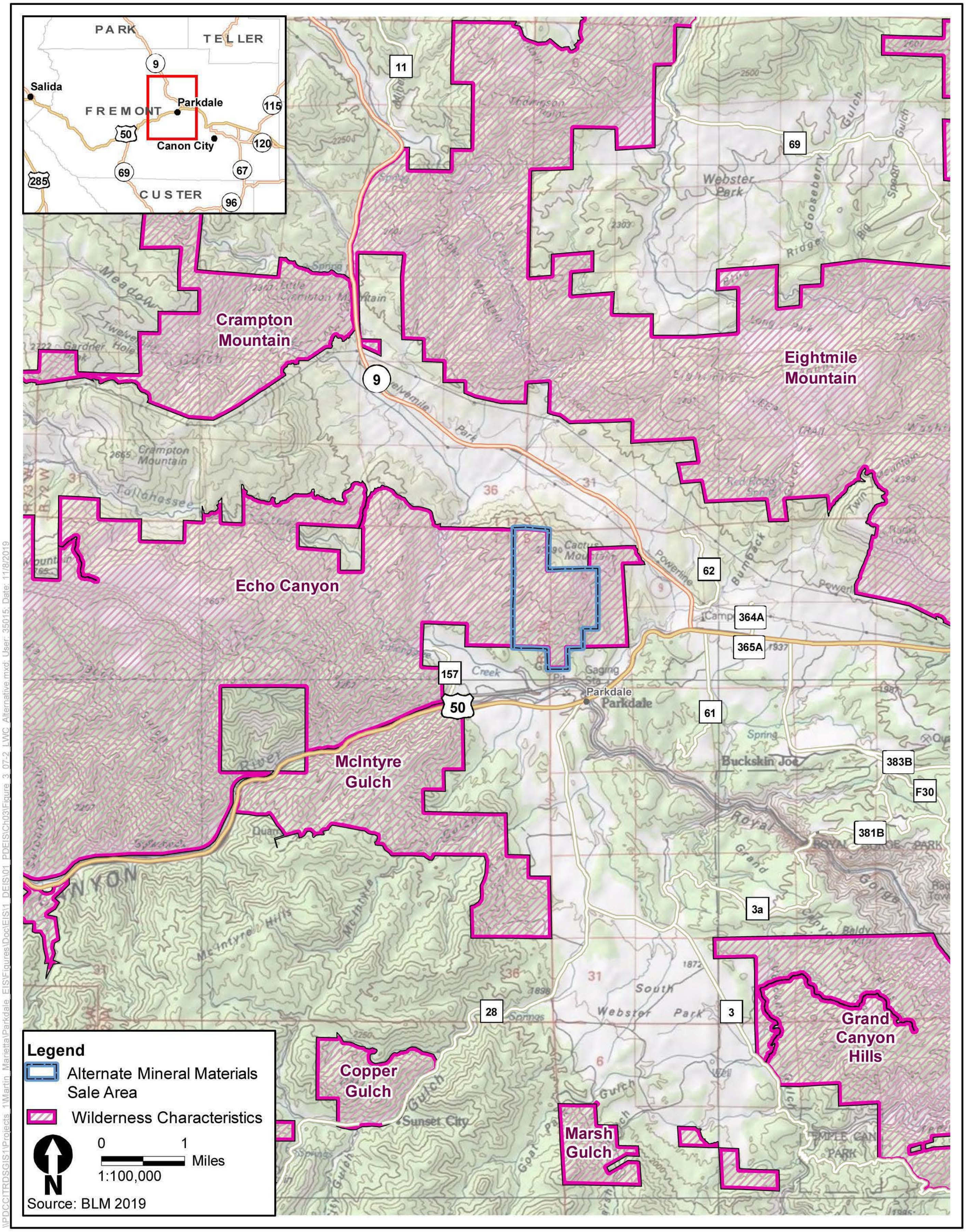


Figure 3.7-2
Alternate Mineral Materials Sale Area and Lands with Wilderness Characteristics

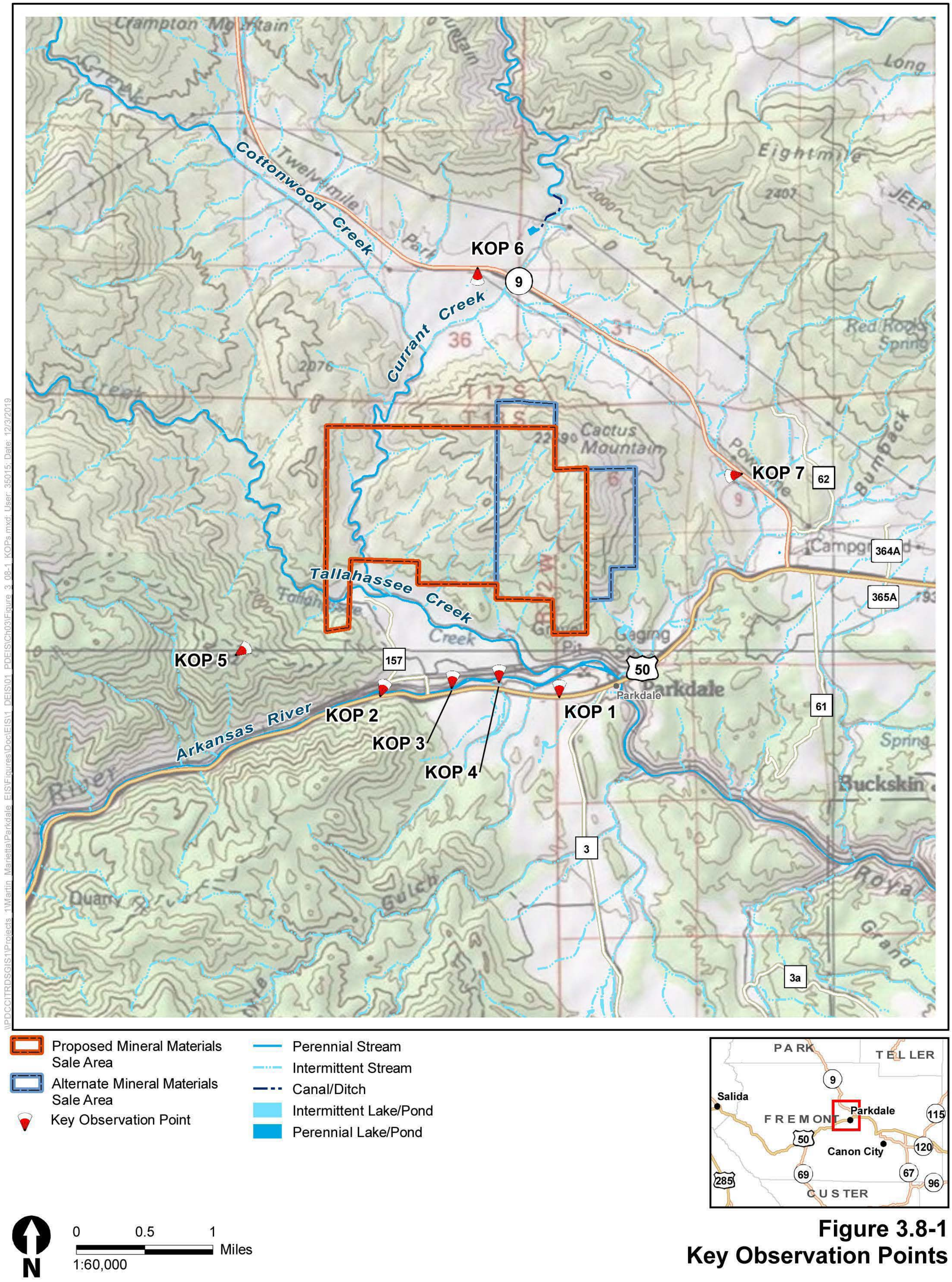


**Figure 3.8-1**
**Key Observation Points**

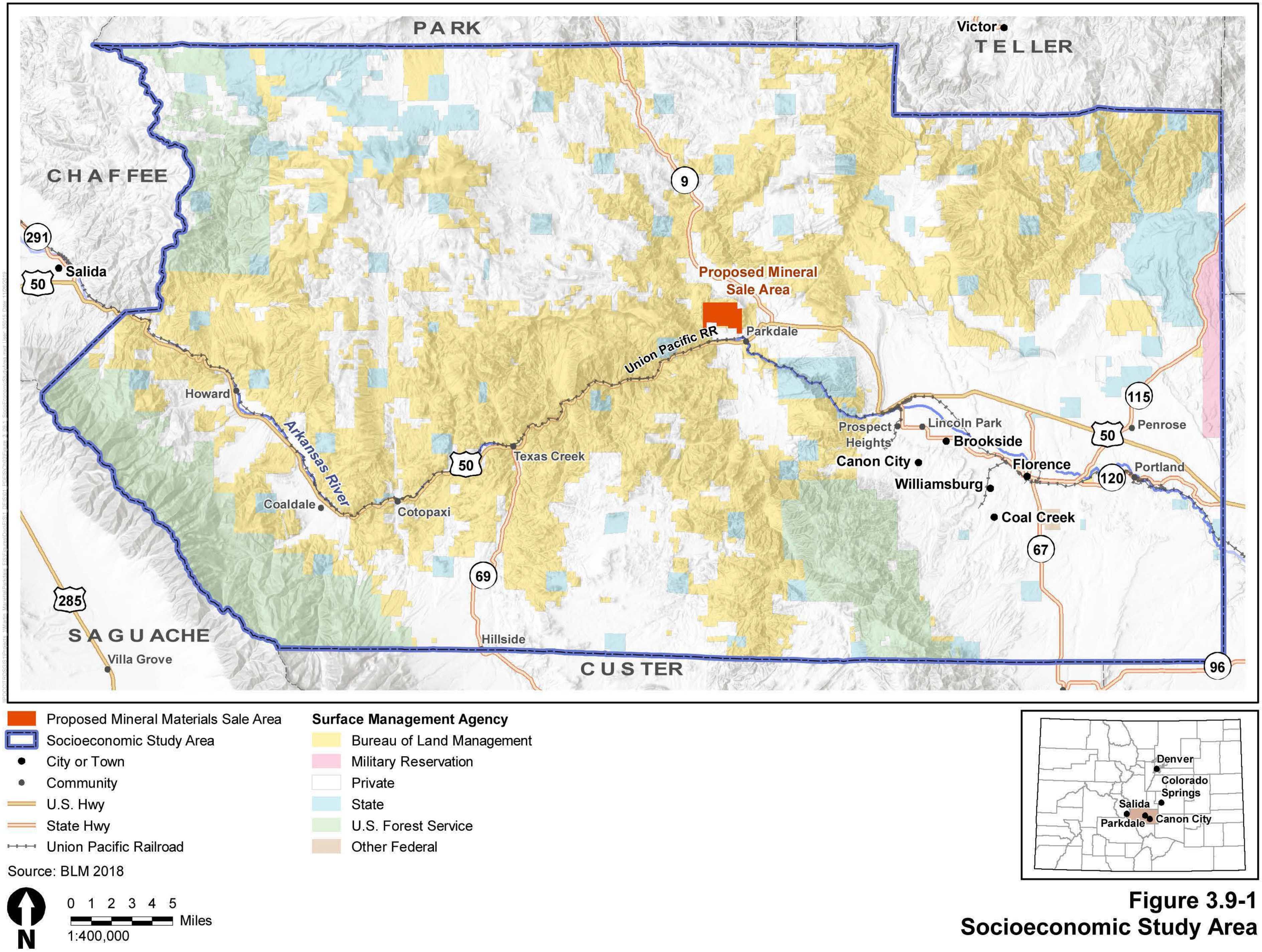
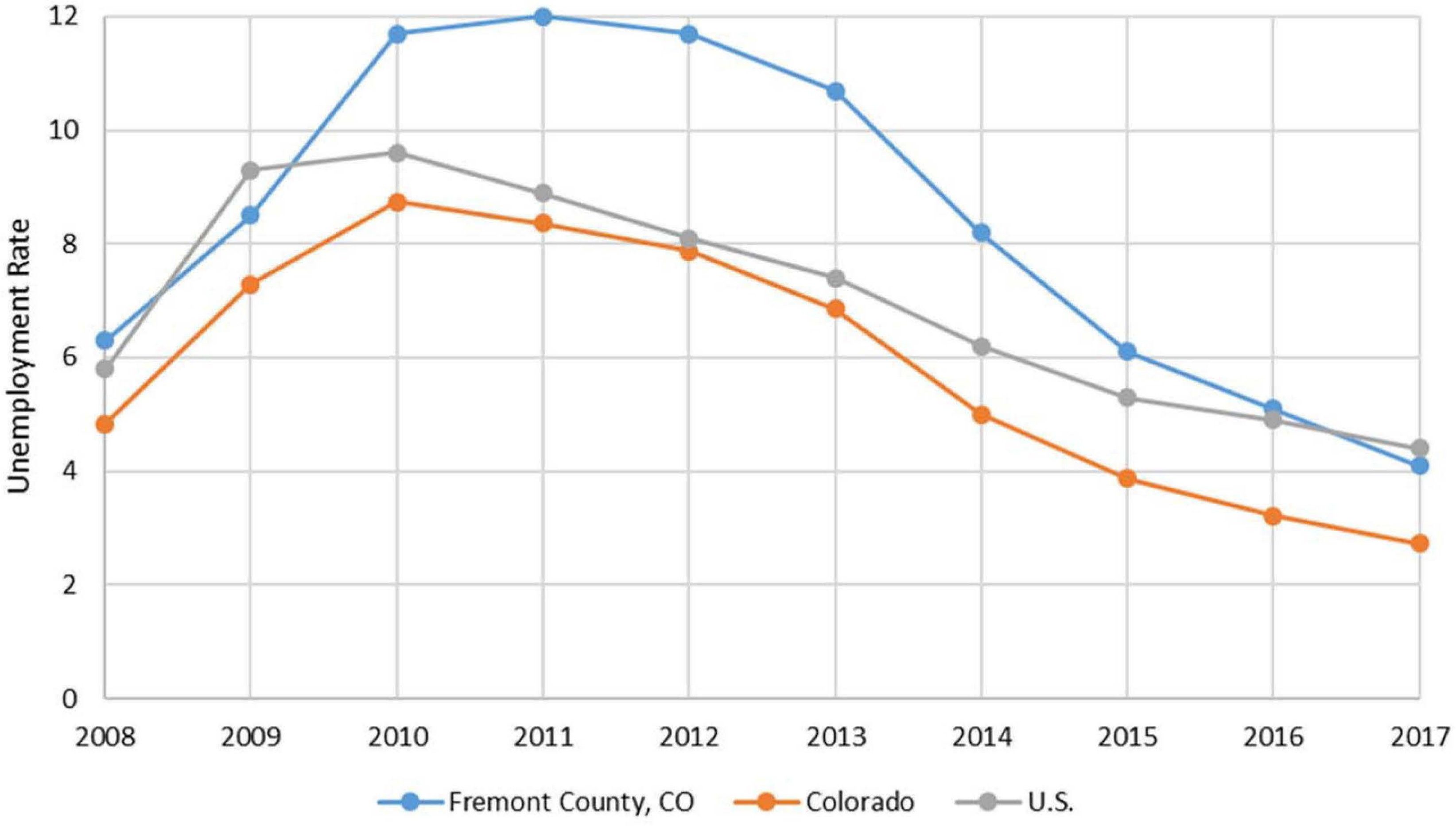
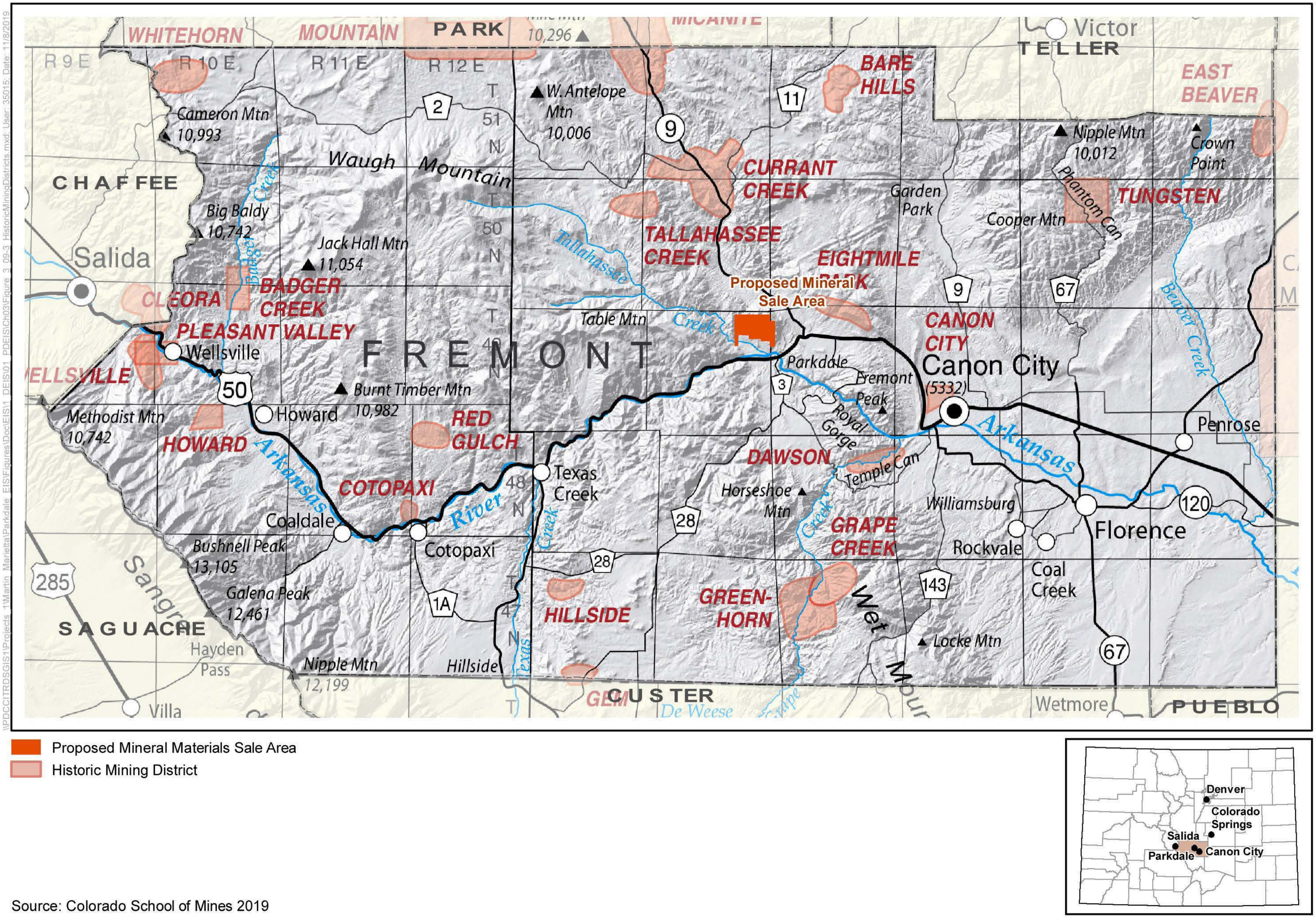


**Figure 3.9-1**
**Socioeconomic Study Area**

**Figure 3.9-2. Unemployment Rates, 2008-2017**



Sources: (BLS 2018a)



🟥 Proposed Mineral Materials Sale Area

▨ Historic Mining District

Source: Colorado School of Mines 2019

N

0 1 2 3 4 5 Miles

1:400,000

**Figure 3.9-3**
**Fremont Historic Mining Districts**

***Draft Environmental Impact Statement***
***Parkdale Quarry Expansion Project***

# *Appendix D*

Part 1 - Mining and Reclamation Plan

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# PARKDALE QUARRY EXPANSION
# MINERAL MATERIALS COMPETITIVE SALE COC-078119
# MINING AND RECLAMATION PLAN

## 1. Introduction

Martin Marietta Materials has requested the Parkdale Mineral Materials Competitive Sale COC-078119 in order to expand operations at its privately owned Parkdale Quarry onto adjacent BLM-administered lands. The Parkdale Quarry is located in Fremont County, Colorado, approximately 12 miles west of the Town of Canon City, Colorado. The Parkdale Quarry is situated on the north side of the Arkansas River, and north of U.S. Highway (US) 50 in portions of Sections 11, 12, 13, and 14, Township 18 South, Range 72 West, Sixth Prime Meridian. Martin Marietta proposes to expand operations generally north onto BLM property in portions of Sections 1, 2, 11, and 12, Township 18 South, Range 72 West, Sixth Prime Meridian (the Mineral Materials Sale Area). The general location of the Parkdale Quarry and the proposed Mineral Materials Sale Area is shown on the Vicinity Map, Figure 1. The Parkdale Quarry and the proposed Mineral Materials Sale Area are shown in additional detail on the Site Map, Figure 2. The elevation of the Mineral Materials Sale Area ranges from approximately 5,790 feet to 6,960 feet, and consists of mountainous topography.

Mining is expected to disturb approximately 700 acres in the Mineral Materials Sale Area over the life of the mine. The Mineral Materials Sale Area is surrounded by an approximate 760-acre buffer that will be included in the mining permit boundaries, but will be left undisturbed. The purpose of the buffer is to provide a separation between the area where mining will occur and surrounding areas open to the public. Activities that create a ground disturbance will be restricted to the Mineral Materials Sale Area. Mineral processing, loadout, transportation, and associated activities will continue to be performed on Martin Marietta Materials' owned property south of the Mineral Materials Sale Area. Activities that will be conducted on the Mineral Materials Sale Area include:

- Construction and operation of access/haul roads onto and within the Mineral Materials Sale Area;
- Excavation of mineral materials using explosives and/or heavy duty excavation equipment;
- Loading of mineral materials onto haul trucks and/or an overland conveyor system for transport to the processing facilities on the adjacent private land;
- Reclamation of disturbed areas in accordance with our reclamation plan, to be approved by BLM and the Colorado Department of Reclamation, Mining, and Safety.

Final reclamation of the Mineral Materials Sale Area, as envisioned, will create a landscape that substantially mimics the landscape currently present in Webster Park, south of and bordering the Mineral Materials Sale Area.

## 2. Mine Phasing

Mining of the Mineral Materials Sale Area will be performed in five phases progressing generally from west and northwest to southeast. The areas expected to be disturbed by the five mining phases are shown on the Parkdale Expansion Mine Plan, Map 1. The haul road used to transport mined materials to Martin Marietta's property for processing will be constructed prior to the commencement of Phase 1 mining. The mine plan and mining phases are designed to minimize the area of disturbed unreclaimed ground within the Mineral Materials Sale Area, and to minimize the length of time that a piece of ground within the Mineral Materials Sale Area remains disturbed and unreclaimed. The mine plan and phasing is also designed to minimize viewshed impacts along the Arkansas River/U.S. Highway 50 corridor from the mining operation in the Mineral Materials Sales Area. Viewshed impacts will be minimized by using a technique called "mine from behind" wherein the existing topography acts as a view screen, and where mining of visible elevated areas is conducted from the side away from the viewpoint. Additionally, the sandstone outcroppings along the southern edge of the Mineral Materials Sales Area will remain undisturbed to further screen mining from being visible along the Arkansas River/U.S. Highway 50 corridor.

We anticipate that Phase 1 of the mining process will disturb approximately 81 acres over a period of 15 to 20 years in the area designated as the West Pit. Phase 2 mining will disturb approximately 166 acres over an estimated period of 20 to 40 years in the area designated as the West Central Pit. We estimate that Phase 3 will disturb approximately 228 acres over a period of 25 to 50 years in the area designated as the Central Pit. The Phase 4 will disturb approximately 110 acres over an estimated 15 to 30 year period in the area designated as the East Central Pit. Phase 5 mining will disturb approximately 113 acres in the area designated as the East Pit, and will take an estimated 15 to 25 years. The generalized post-mining topography and a three dimensional rendering of general landscape at the end of mining each phase is shown on the mine plans for each phase, Maps 2A and B through 6A and B. The three dimensional renderings also help to demonstrate how visual impacts are minimized by using topographic features. Each mine phase will be substantially completed before the next is started. Reclamation activities will begin in a particular part of a pit area when mining is complete in that part of the pit area, and there is no longer a need to access it. Thus, reclamation will be occurring concurrently with mining, in order to minimize the total disturbed acreage.

## 3. Haul Road Construction

The haul road running along the southern and southwestern boundary of the Mineral Materials Sale Area, shown on Map 1, will be constructed prior to the commencement of mining as the main haul road serving the area. The main haul road will lead from the material processing facilities on the Martin Marietta owned portion of the quarry. The main haul road will remain in place throughout the life of the mine. Semi-permanent and temporary haul roads will be constructed to bring material from the pit areas to the main haul road. Haul roads will be constructed in a manner that allows for safe movement and sound performance of vehicles, as warranted by the conditions encountered in a particular location. In general, haul roads will have an approximate six-inch thick fine gravel surfaced wearing course over approximately nine inches of coarse crushed rock, which will in turn sit on approximately 18 inches of compacted aggregate base over the native subgrade unless conditions dictate that an alternate road section will meet safety and performance objectives.

Haul roads will generally be at least 60 feet in width to provide ample room for vehicles to safely pass each other. Maximum grades on the haul roads will generally be 10-percent or less, and roads will be designed with a 2-percent cross fall to facilitate drainage. Horizontal curves will generally be designed with a radius of at least 150 feet and will be designed with approximately 10-percent superelevation to safely accommodate anticipated travel speeds. Vertical curves will be flat enough to allow for safe braking distances by loaded haul trucks to avoid obstruction in the travel way. A drainage ditch will run along the downhill side of the haul road, and haul roads will be bordered by berms, the height of which will be at least as high as the axle on the largest piece of equipment expected to use the road. Haul roads will be watered regularly to control dust, and will also be treated with a chemical dust suppressant such as calcium or magnesium chloride. A typical haul road cross section is shown on Figure 3. If a conveyor is installed to transport material from the Mineral Materials Sale Area to the processing area on Martin Marietta-owned property, it will follow and be directly adjacent to the main hail road.

## 4. Bench Design

Two types of mining benches will be created during the mining process, production benches and reclamation benches. The production benches are those created during the active mining process, the face of which is the source of the mined materials. Reclamation benches are those which remain when mining is completed, and are generally located at the mining disturbance boundary. Production benches will not exceed 70 feet in height, have a face angle anticipated to be approximately 80 degrees, and a width of not less than 40 feet. Temporary safety berms will be constructed parallel to and at the top edge, and ten feet from the base of production benches that are not actively being mined. Reclamation benches will be approximately 35 feet high, have a bench width of approximately 30 feet, and a face angle of approximately 80 degrees, resulting in an overall approximate 1:1 (horizontal to vertical) reclamation slope. The actual bench geometry selected will be that which provides a minimum static factor of safety of 1.3, based on rock slope stability analysis. Cross-sections of typical production and reclamation benches are shown in Figure 4.

## 5. Materials Handling

Overburden and topsoil will be stripped from areas to be mined by the use of conventional heavy earthmoving equipment. Overburden and topsoil will be placed in stockpiles for reuse during the reclamation process. Overburden and topsoil stockpiles that will not be used within six months of excavation will be seeded to establish a vegetative cover from stabilization and protection from erosion.

Aggregate materials will be excavated from the Mineral Materials Sale Area by using explosives to free the rock from the matrix. All explosive work on the site will be performed by a licensed blaster. The explosives needed for each blast will be transported to the site immediately before blast holes are loaded and excess explosives will be removed from the site after the blast holes are loaded. Explosives will not be stored on BLM property.

Once the aggregate material is blasted free of the rock matrix, a loader or excavator will be used to handle and load it into off-road dump trucks and/or onto a conveyor for transport to the material processing area on the adjacent Martin Marietta-owned property. Blocks of rock that are too large to process (oversize material) or that will not be used as riprap will be temporarily set aside adjacent to the excavation site for mechanical size reduction. An excavator equipped with a mechanical breaker or other mechanical means will be used to reduce oversized material to an appropriate size for transport and processing.

## 6. Reclamation

The primary goal for reclamation of the mining area will be to create a topographic and ecological setting that is similar to that of Webster Park and the hillsides surrounding Webster Park, south of the Parkdale Quarry. The landscape of Webster Park is shortgrass prairie on the lowland areas, bordered by hillside/montane areas of mountain scrubland dominated by sagebrush, and mountain mahogany. Reclamation activities proposed for the Mineral Materials Sale Area will result in the replacement of the current pinion-juniper plant community which has encroached on the area with plant communities that more closely resemble predevelopment conditions in the area and that enhance wildlife habitat and habitat diversity, and provide winter forage for bighorn sheep and mule deer. Since the reclamation activities will be ongoing over the anticipated 100+ year life of the quarry, the restoration will also yield habitat with diverse age-class plant communities. Conceptual 3-Dimensional views from the northwest and northeast respectively are shown in Figures 5 and 6, and provide a generalized overview of what the topography of the area will look like after reclamation.

### 6.1. Grading

### 6.1.1. Valley Floor

The Mineral Materials Sale Area currently drains to the south and southwest, with the majority of the runoff from the area flowing to Current Creek and Tallahassee Creek through three main drainage areas, as shown on Figure 7, the Parkdale Expansion Topographic Map. Once mining is completed, the topography of the valley floor created in the mining process will generally slope to the southwest and south, as shown on Figure 8, the Parkdale Expansion Proposed Mine Plan. Drainage channels will be excavated into the valley floor that connect to the three existing main drainages outside the Mineral Materials Sales Area. The drainage channels will be laid out so as to continue to generally direct water from the areas currently draining to the main drainage areas. A conceptual layout for the drainage channels is presented on Figure 9. The drainage channels will be constructed with a depth, cross-section, and sinuosity similar to that of the natural drainages in Webster Park that feed into the south side of the Arkansas River. Some side drainages will be constructed to better capture and direct runoff within the Mineral Materials Sale Area.

### 6.1.2. Benches

Reclamation benches will be approximately 35 feet high, have a bench width of approximately 30 feet, and a face angle of approximately 80 degrees, resulting in an overall approximate 1:1 (horizontal to vertical) reclamation slope. Reclamation of individual benches will be accomplished by regrading and/or backfilling benches to an approximate 1:1 (horizontal to vertical) reclamation slope to generally blend with the surrounding topography. Some areas of bare rock will remain as bare rock and reclamation of areas of bare rock will be limited to that practical for minimizing obvious disturbance. Based on conversations with the Colorado Department of Parks and Wildlife staff, we anticipate leaving some parts of some mining benches with near vertical slopes, as they mimic topography that serves as escape habitat for bighorn sheep to avoid predators. Benches will be backfilled as final mining is completed, and fill will be placed using a bulldozer to grade and compact slope fill material. A generalized cross-section showing the reclaimed bench geometry is presented on Figure 4.

## 6.2. Topsoil Replacement

Heavily compacted soil surfaces will be ripped to depths varying from 6 to 12 inches, depending upon the degree of compaction prior to the replacement of topsoil. Based on the adjacent Parkdale Quarry, the existing topsoil depth in the Mineral Materials Sale Area generally ranges from 0 inches to 18 inches. Replacement topsoil depths comparable to those prior to mining, or an average of 9 inches evenly placed, will be used.

Prior to reseeding of disturbed areas, topsoil will be placed to achieve a generally uniform thickness; minimize compaction and erosion; and preserve biological, physical, and chemical properties. Where practical, soil will be applied so as to minimize grading requirements and compaction from multiple equipment passes over the area being reclaimed. Final grading will generally be completed parallel to the topographic contour of the area, where safety conditions permit, to minimize erosion and maximize site stability. Ideally, soil will be applied on areas to be seeded less than 30 days prior to seeding.

## 6.3. Fertilizer Application

Prior to reseeding of disturbed areas, we will contract with a laboratory proficient in the analysis of soils for agricultural purposes. Two composite samples will be collected from the reclamation topsoil at a depth from 0 to 6 inches, and per 1,000 linear feet of bench or 10 acres of valley floor. Samples will be taken with either a tile spade or soil auger free of foreign substances or rust. No galvanized tools will be used. About one quart of material will be collected for each composite sample. The laboratory will be briefed on the following items for each sample or appropriate set of samples:

- Plant species to be established;
- Type of seedbed preparation technique;
- Type of mulching practices;
- Approximate slope;
- Problems or conditions; and
- Future land use.

All samples will be placed in clean polyethylene bags at the time of collection, sealed and delivered to the laboratory as soon as possible. When samples cannot be delivered within 24 hours of collection, they will be air-dried in a "dust free" environment for about 48 hours or as recommended by the laboratory. Samples will be analyzed for:

- pH;
- Potassium (parts per million);
- Texture;
- Electrical conductivity (millimhos per centimeter);
- Percent organic matter;
- Lime estimate;
- NH4-N and N03-N (parts per million);
- Sodium adsorption ratio; and if necessary
- Phosphorus (parts per million)

The fertilizer application concentration will be based on recommendations from the laboratory sample analyses. Fertilizer will be broadcast over the seedbed using hand- operated "cyclone-type" seeders, rotary broadcast equipment attached to construction or revegetation machinery, or using aerial broadcast seeding equipment. Fertilizer broadcast equipment will be equipped with metering devices. Fertilizer application will take place prior to final seedbed preparation treatment to ensure the incorporation of fertilizer into the seedbed. Fertilizer broadcasting operations will not be conducted when wind velocities would interfere with even fertilizer distribution.

## 6.4. Reclamation Seed Mixtures

The following reclamation seed mixtures are proposed for use in the Mineral Materials Sale Area.

SOIL STOCKPILE STABILIZATION (26 POUNDS PER ACRE)

| **Species Preferred** | | **Variety** | **Lbs/Acre** | **PLS/Acre** |
|---|---|---|---|---|
| Desert wheatgrass | Agropyron desertorum | Arriba, Nordan | 5.0 | 875,000 |
| Thickspike wheatgrass | Agropyron dasystachyum | Critana | 10.0 | 1,860,000 |
| Western wheatgrass | Agropyron smithii | Arriba, Barton | 6.0 | 756,000 |
| Yellow Sweetclover | Melilotus officinalis | | 5.0 | 1,050,000 |

ROADS AND QUARRY FLOORS (20 POUNDS PER ACRE)

| **SPECIES** | | Weight-Percent | Seeds - Percent | Seeds per Pound | Seeds per Pound Mix |
|---|---|---|---|---|---|
| Blue Grama Grass | Bouteloua gracilis | 11.00% | 26.96% | 825,000 | 90,750 |
| Sideoats Grama Grass | Bouteloua curlipendula | 18.00% | 10.15% | 190,000 | 34,200 |
| SpikeMuhly | Muhlenbergia wrighti | 2.00% | 9.50% | 1,600,000 | 32,000 |
| Indian Ricegrass | Oryzopsis hymenoides | 21.00% | 8.79% | 141,000 | 29,810 |
| Sheep's Fescue | Festuca ovina | 4.00% | 8.08% | 680,000 | 27,200 |
| Sand Dropseed | Sporobolus cryptandrus | 0.50% | 7.72% | 5,200,000 | 26,000 |
| Thickspike Wheatgrass | Agropyron dasystachyum | 16.00% | 7.32% | 154,000 | 24,640 |
| Western Wheatgrass | Agropyron smithii | 20.00% | 7.13% | 120,000 | 24,000 |
| Canby's Bluegrass | Poa canbyi | 2.00% | 5.50% | 925,500 | 18,510 |
| Purple Three-Awn | Aristida purpurea | 1.00% | 0.77% | 260,000 | 2,600 |
| Fringed Sage | Artimesia frigida | 0.25% | 3.34% | 4,500,000 | 11,250 |
| Priare Sage | Artemisia ludoviciana | 0.25% | 3.34% | 4,500,000 | 11,250 |
| Alfalfa | Medicago sativa | 2.00% | 1.25% | 210,000 | 4,200 |
| Fourwing Saltbush | Atriplex canescens | 1.00% | 0.15% | 52,000 | 520 |
| Skunkbush Sumac | Rhus aromatica | 1.00% | 0.03% | 10,600 | 106 |

QUARRY BENCHES (20 POUNDS PER ACRE)

| SPECIES | | Weight-Percent | Seeds - Percent | Seeds per Pound | Seeds per Pound Mix |
|---|---|---|---|---|---|
| Blue Grama Grass | Bouteloua gracilis | 17.00% | 30.73% | 825,000 | 140,250 |
| Sandberg Bluegrass | Poa sandbergii | 6.00% | 12.17% | 925,500 | 55,530 |
| Sand Dropseed | Sporobolus cryptandrus | 1.00% | 11.39% | 5,200,000 | 52,000 |
| Sideoats Grama Grass | Bouteloua curlipendula | 25.00% | 10.41% | 190,000 | 47,500 |
| Sheep's Fescue | Festuca ovina | 6.00% | 8.94% | 680,000 | 40,800 |
| Indian Ricegrass | Oryzopsis hymenoides | 25.00% | 7.72% | 141,000 | 35,250 |
| Little Bluestem | Andropogon scoparius | 6.00% | 3.42% | 260,000 | 15,600 |
| Canadian Wild Rye | Elymus canadensis | 3.00% | 0.76% | 115,000 | 3,450 |
| Purple Three-Awn | Aristida purpurea | 1.00% | 0.57% | 260,000 | 2,600 |
| Needle & Thread | Stipa comata | 2.00% | 0.50% | 115,000 | 2,300 |
| Blanketflower | Gaillardia aristata | 2.00% | 1.28% | 293,000 | 5,860 |
| Wild Bergamot | Monarda fistulosa | 2.00% | 0.92% | 210,000 | 4,200 |
| Four-wing Saltbush | Atriplex canescens | 1.00% | 10.96% | 5,000,000 | 50,000 |
| Mountain Mahogany | Cercocarpus montanus | 1.00% | 0.13% | 59,000 | 590 |
| Wood's Rose | Rosa woodsi | 1.00% | 0.08% | 35,000 | 350 |
| Skunkbush Sumac | Rhus aromatica | 1.00% | 0.02% | 10,600 | 106 |

## 6.5. Seeding

Within five days after the application of fertilizer, but prior to seeding, the topsoil will be prepared for seeding by utilizing a disk, harrow or chisel plow to roughen the surface, depending upon site conditions and availability. The topsoil surface will then be left in a roughened condition to inhibit erosion and provide a receptive surface for subsequent reclamation procedures.

Disturbed areas will be revegetated with the approved seed mix. Seeds will come from nursery plant stock grown on the Mineral Materials Sales Area or adjacent Martin Marietta-owned area, or will be obtained in standard containers with seed name; lot number; net weight; and percentages of purity, germination, hard seed, and maximum weed seed content clearly marked for each seed type. Seed supplies will not contain the seeds of any state recognized noxious weed species. A certificate stating that each seed lot has been tested by a laboratory with respect to the above requirements will be delivered with the seed. Only certified seed of named varieties will be used where varieties are specified and can be obtained. Sources for "common" seed will be selected with comparable climatic and elevation characteristics similar to the project's climate and elevation. Legume seed will be inoculated with the correct rhizobium prior to shipping. All legume seed will be planted prior to the expiration date on the inoculum tag or reinoculated within 24 hours prior to planting. Seeds will be applied to benches and the valley floor area at a seeding rate of approximately 20 pounds of pure live seed (PLS) per acre which equates to approximately 210 seeds per square foot. Seeds will be applied to stockpiles at a seeding rate of approximately 26 PLS per acre which equates to approximately 104 seeds per square foot. Seed will be broadcast over the seedbed using hand- operated "cyclone-type" seeders, rotary broadcast equipment attached to construction or revegetation machinery, or aerial broadcast (hydroseeding) methods.

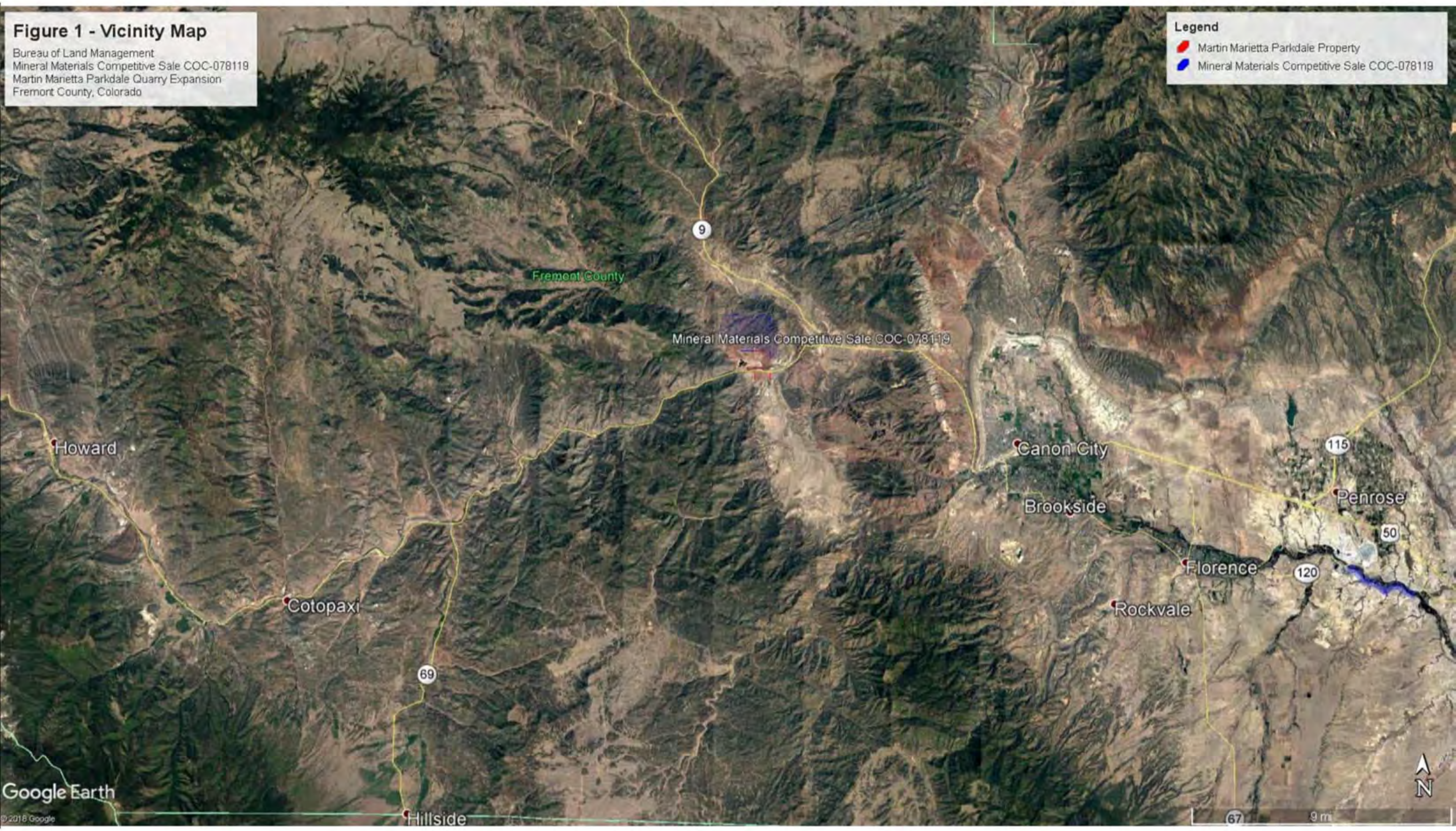
## 6.6. Mulching

Mulching will be conducted immediately following seeding operations, where deemed necessary at the time of application to meet reclamation objectives. Straw mulch will be spread evenly by hand or mechanical blower in those areas where it is deemed necessary. When mulching slopes, application will be initiated at the top of the slope, working down slope, where possible. Mulch will not be spread when wind velocities would prohibit even material distribution. Straw Mulch will not be musty, moldy, caked, or decayed and will be free of noxious weeds or noxious weed seeds. It will be delivered in an air-dry condition. The majority of stems will be 10 to 12 inches long or longer prior to application if the mulch is to be anchored by crimping. Approximately two tons of mulch per acre will be applied to all areas to be mulched.

# MAPS AND FIGURES

Figure 1 - Vicinity Map
Figure 2 - Site Map
Figure 3 – Typical Haul Road Cross-section
Figure 4 - Cross-sections of Typical Production and Reclamation Benches
Figure 5 - Parkdale Conceptual Plan - Northwest 3-Dimensional View
Figure 6 - Parkdale Conceptual Plan - Northeast 3-Dimensional View
Figure 7 - Parkdale Expansion Topographic Map
Figure 8 - Parkdale Expansion Proposed Mine Plan
Figure 9 - Conceptual Drainage Channel Layout

Map 1- Parkdale Expansion Mine Plan
Map 2 – West Pit Mine Plan Showing the Approximate Post-mining Topography
Map 3 – West Central Pit Mine Plan Showing the Approximate Post-mining Topography
Map 4 – Central Pit Mine Plan Showing the Approximate Post-mining Topography
Map 5 – East Central Pit Mine Plan Showing the Approximate Post-mining Topography
Map 6 – East Pit Mine Plan Showing the Approximate Post-mining Topography



## Figure 1 - Vicinity Map

Bureau of Land Management
Mineral Materials Competitive Sale COC-078119
Martin Marietta Parkdale Quarry Expansion
Fremont County, Colorado

**Legend**

- 🟥 Martin Marietta Parkdale Property
- 🟦 Mineral Materials Competitive Sale COC-078119

Legend

- 🟥 Existing Mine Property Boundary
- 🟦 Proposed Mine Expansion Boundary
- Surface Water or Drainage Feature

Note: Aerial imagery from Bing Maps

Martin Marietta

Parkdale Expansion Aerial Map

Parkdale Quarry
Fremont County, Colorado

QUARRY: Parkdale

| | | | |
|---|---|---|---|
| DWN BY: VLH | DATE: 1/24/2018 | JOB. NO. | |
| CK. BY: JBK | SCALE: 1"=500' | SHEET NO. | DWG. NO: Figure 2 |

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FILE NAME: Parkdale Expansion Map.dwg

DESIGN FIRM: Geology and Exploration

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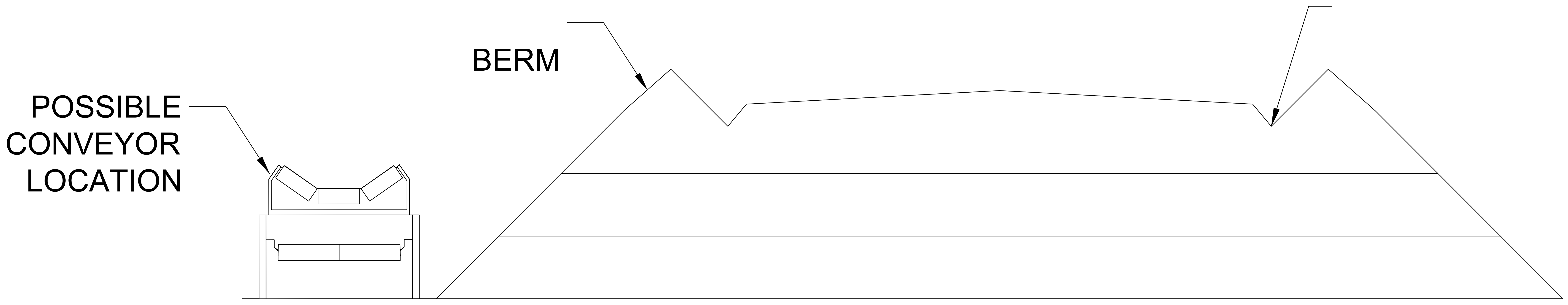

# *NOT TO SCALE

*The actual road section used for a location will be that which allows for safe movement and sound performance of vehicles, as warranted by the conditions encountered

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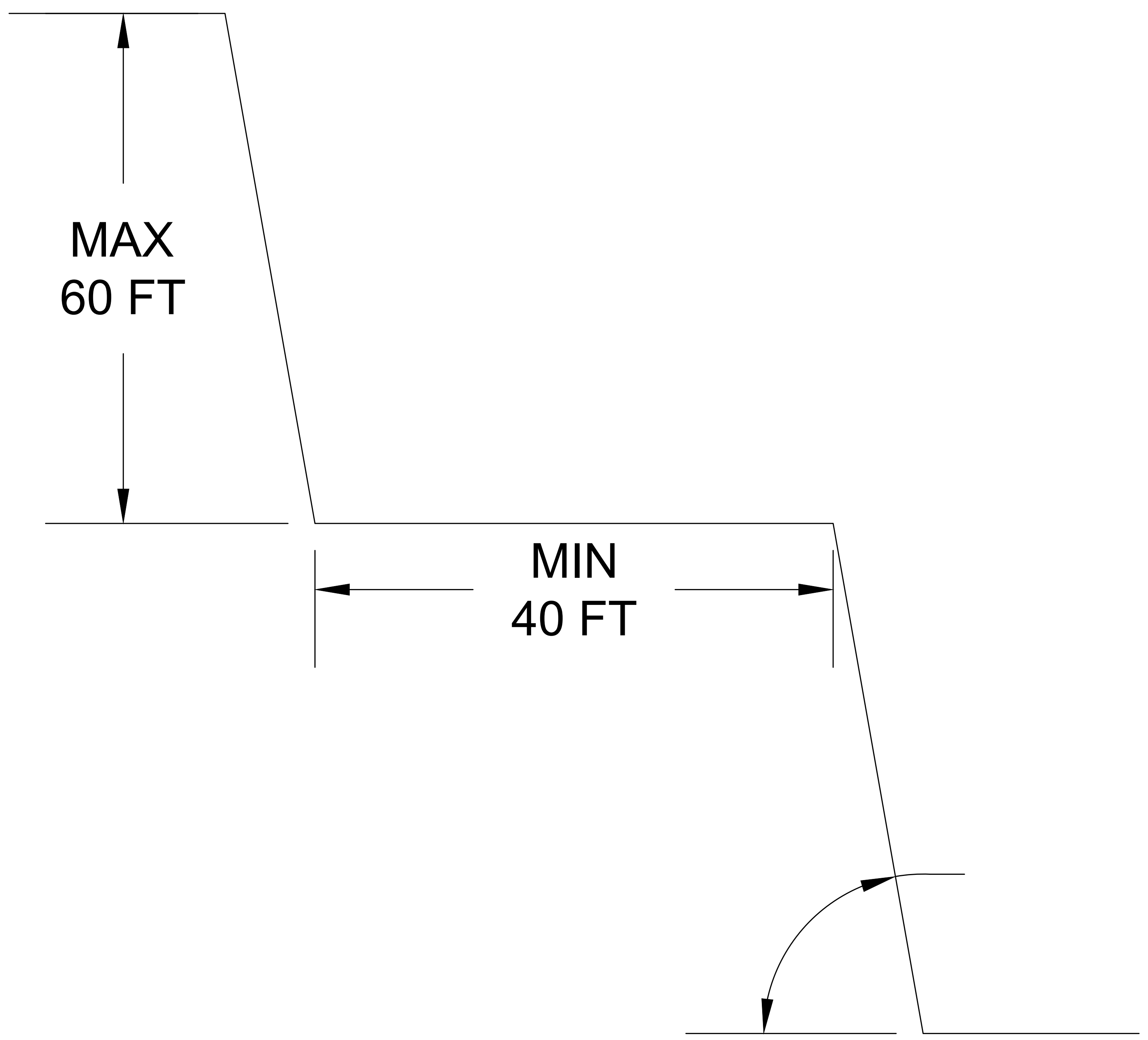
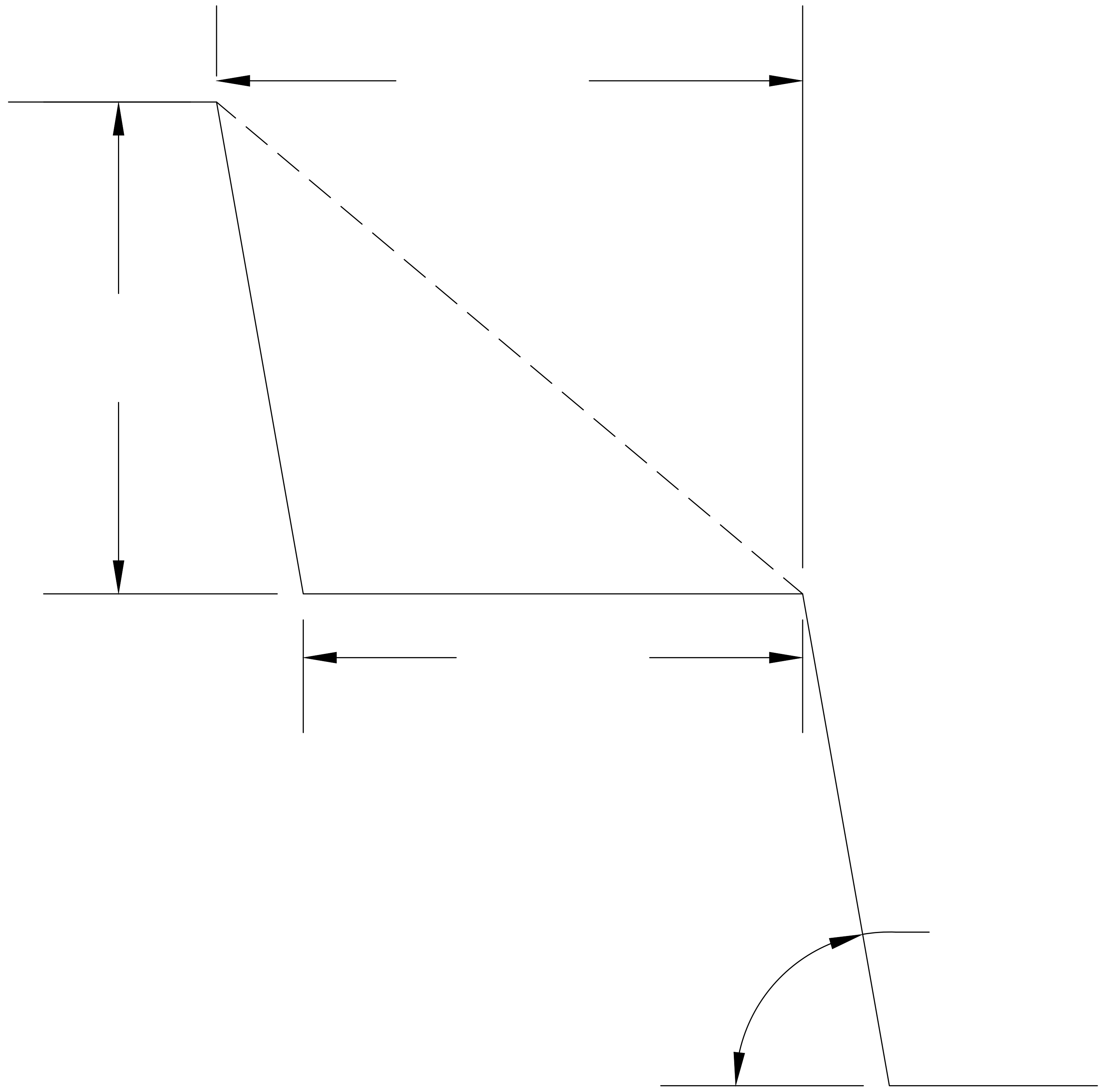
Marietta





*NOT TO SCALE

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LEGEND

🟥 Exisiting Mine Property Boundary

🟦 Proposed Mine Expansion Boundary

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FILE NAME: Parkdale Conceptual Plan.dwg

DESIGN FIRM: Geology and Exploration

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## Parkdale Conceptual Plan Northwest View

Parkdale Quarry
Fremont County, Colorado

QUARRY: Parkdale

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| DWN BY: VLH | DATE: 1/24/2018 | JOB. NO. | |
| CK. BY: JBK | SCALE: | SHEET NO. | DWG. NO: Figure 5 |

LEGEND
Exisiting Mine Property Boundary
Proposed Mine Expansion Boundary

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|  | DATE | REVISION | BY |

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## Parkdale Conceptual Plan Northeast View

Parkdale Quarry
Fremont County, Colorado

QUARRY: Parkdale

DWN BY: VLH
DATE: 1/24/2018
JOB. NO.
CK. BY: JBK
SCALE:
SHEET NO.
DWG. NO: Figure 6

Legend

| | |
|---|---|
| 🟥 | Existing Mine Property Boundary |
| 🟦 | Proposed Mine Expansion Boundary |
| 🟦 | Surface Water or Drainage Feature |
| — | Topographic Contour (USGS, 20 foot interval) |

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Parkdale Topograpic Map

Parkdale Quarry
Fremont County, Colorado

QUARRY: Parkdale

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| DWN BY: VLH | DATE: 1/24/2018 | JOB. NO. | |
| CK. BY: JBK | SCALE: 1"=500' | SHEET NO. | DWG. NO: Figure 7 |

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FILE NAME: Parkdale Expansion Map.dwg

DESIGN FIRM: Geology and Exploration

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Legend

🟧 Resource Area
— Limit of Disturbance
— Bench Contour (35'-tall benches, 1:1 slope)
— Pit Floor Contour (20' interval)
— Surface Water or Drainage Feature
— Proposed Mine Expansion Boundary
— Existing Mine Permit Boundary
— Topographic Contour (USGS, 20' interval)

SCALE
0 500' 1000' 1500'

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Parkdale Expansion Mine Plan

Parkdale Quarry
Fremont County, Colorado

QUARRY: Parkdale
DWN BY: VLH
DATE: 1/24/2018
JOB. NO.
CK. BY: JBK
SCALE: 1"=500'
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DWG NO. Figure 8

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FILE NAME: Parkdale Expansion Map.dwg
DESIGN FIRM: Geology and Exploration

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## Conceptual Drainage Channel Layout

Parkdale Quarry
Fremont County, Colorado

QUARRY: Parkdale

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| DWN BY: CWO | DATE: 12/03/2018 | JOB. NO. |  |
| CK. BY: DWB | SCALE: 1"=300' | SHEET NO. | DWG. NO: Figure 9 |

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FILE NAME: Parkdale Expansion Map 12-03-2018.dwg

DESIGN FIRM: Rocky Mountain Division

Note: Drainage Locations are Approximate,
Final Location will be Determined as Areas are Reclaimed.

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Parkdale Expansion Mine Plan

Parkdale Quarry
Fremont County, Colorado

QUARRY: Parkdale

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FILE NAME: Parkdale Expansion Map 12-03-2018.dwg

DESIGN FIRM: Rocky Mountain Division

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**Martin Marietta**

## Parkdale Expansion - West Pit

Parkdale Quarry
Fremont County, Colorado

QUARRY: Parkdale

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FILE NAME: Parkdale Expansion Map 12-03-2018.dwg

DESIGN FIRM: Rocky Mountain Division

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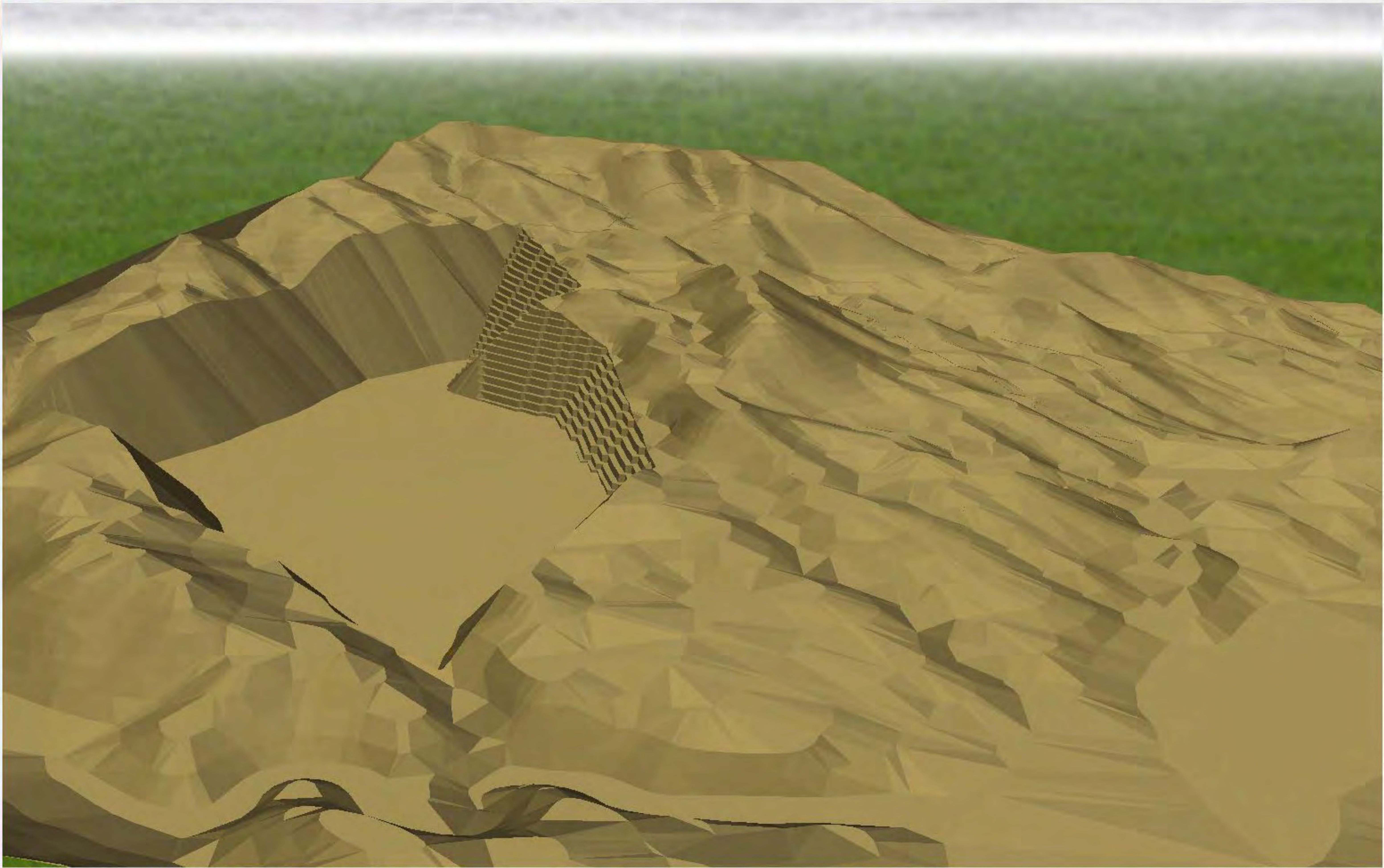

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Parkdale Expansion - West Central Pit

Parkdale Quarry
Fremont County, Colorado

QUARRY: Parkdale

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FILE NAME: Parkdale Expansion Map 12-03-2018.dwg

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FILE NAME: Parkdale Conceptual Plan.dwg

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Parkdale Conceptual Plan Northeast View - West Central Pit

Parkdale Quarry
Fremont County, Colorado

QUARRY: Parkdale

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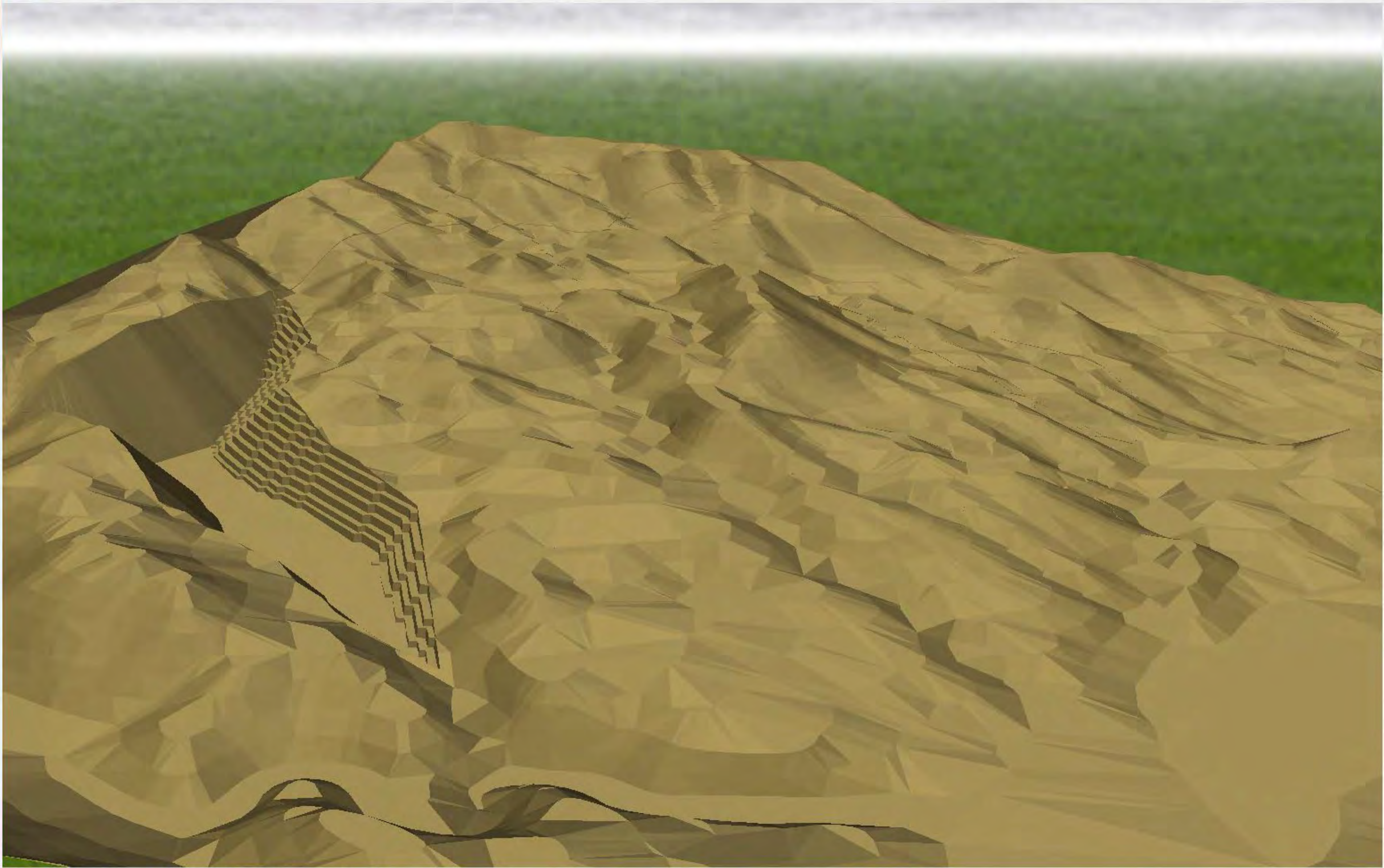

Martin Marietta

## Parkdale Expansion - Central Pit

Parkdale Quarry
Fremont County, Colorado

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FILE NAME: Parkdale Expansion Map 12-03-2018.dwg

DESIGN FIRM: Rocky Mountain Division

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FILE NAME: Parkdale Conceptual Plan.dwg

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Martin Marietta

Parkdale Conceptual Plan Northeast View - Central Pit

Parkdale Quarry
Fremont County, Colorado

QUARRY: Parkdale

DWN BY: CWO
DATE: 12/03/2018
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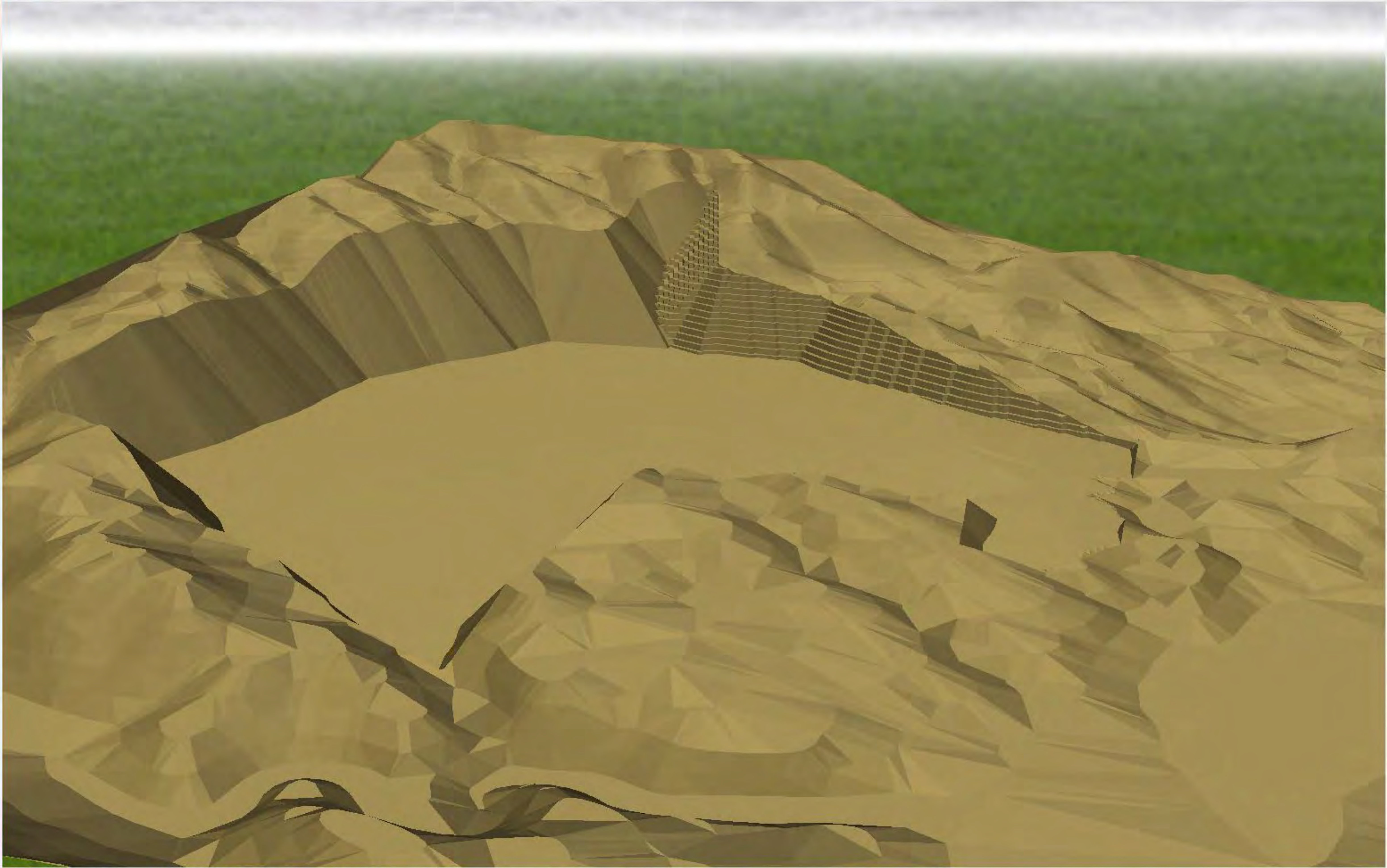

Martin Marietta

## Parkdale Expansion - East Central Pit

Parkdale Quarry
Fremont County, Colorado

QUARRY: Parkdale

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FILE NAME: Parkdale Expansion Map 12-03-2018.dwg

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Parkdale Conceptual Plan Northeast View - East Central Pit

Parkdale Quarry
Fremont County, Colorado

QUARRY: Parkdale
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DATE: 12/03/2018
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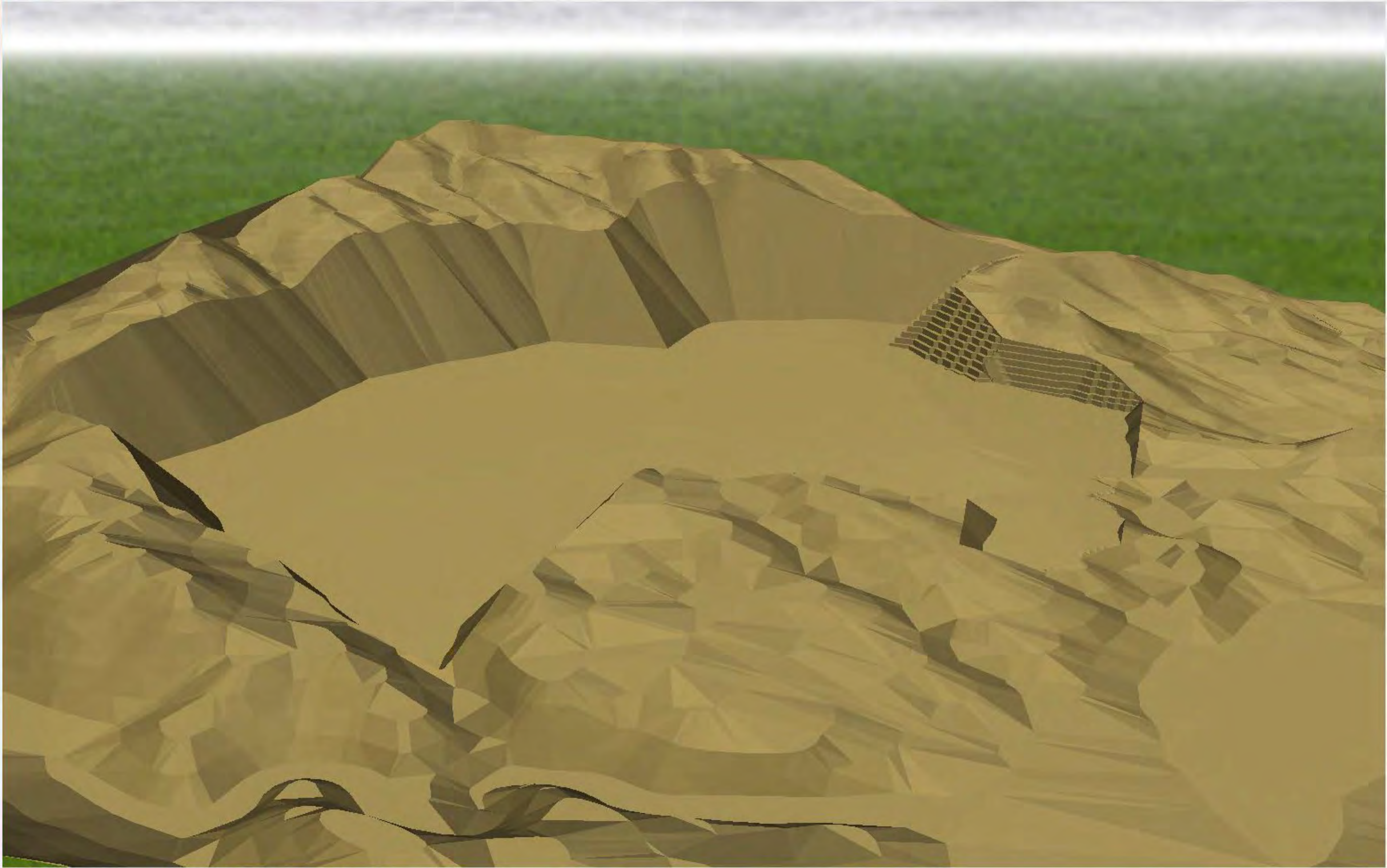

Martin Marietta

## Parkdale Expansion - East Pit

Parkdale Quarry
Fremont County, Colorado

QUARRY: Parkdale

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FILE NAME: Parkdale Expansion Map 12-03-2018.dwg

DESIGN FIRM: Rocky Mountain Division

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FILE NAME: Parkdale Conceptual Plan.dwg

DESIGN FIRM: Rocky Mountain Division

Martin Marietta

Parkdale Conceptual Plan Northeast View - East Pit

Parkdale Quarry
Fremont County, Colorado

QUARRY: Parkdale

| | | | |
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| DWN BY: CWO | DATE: 12/03/2018 | JOB. NO. | |
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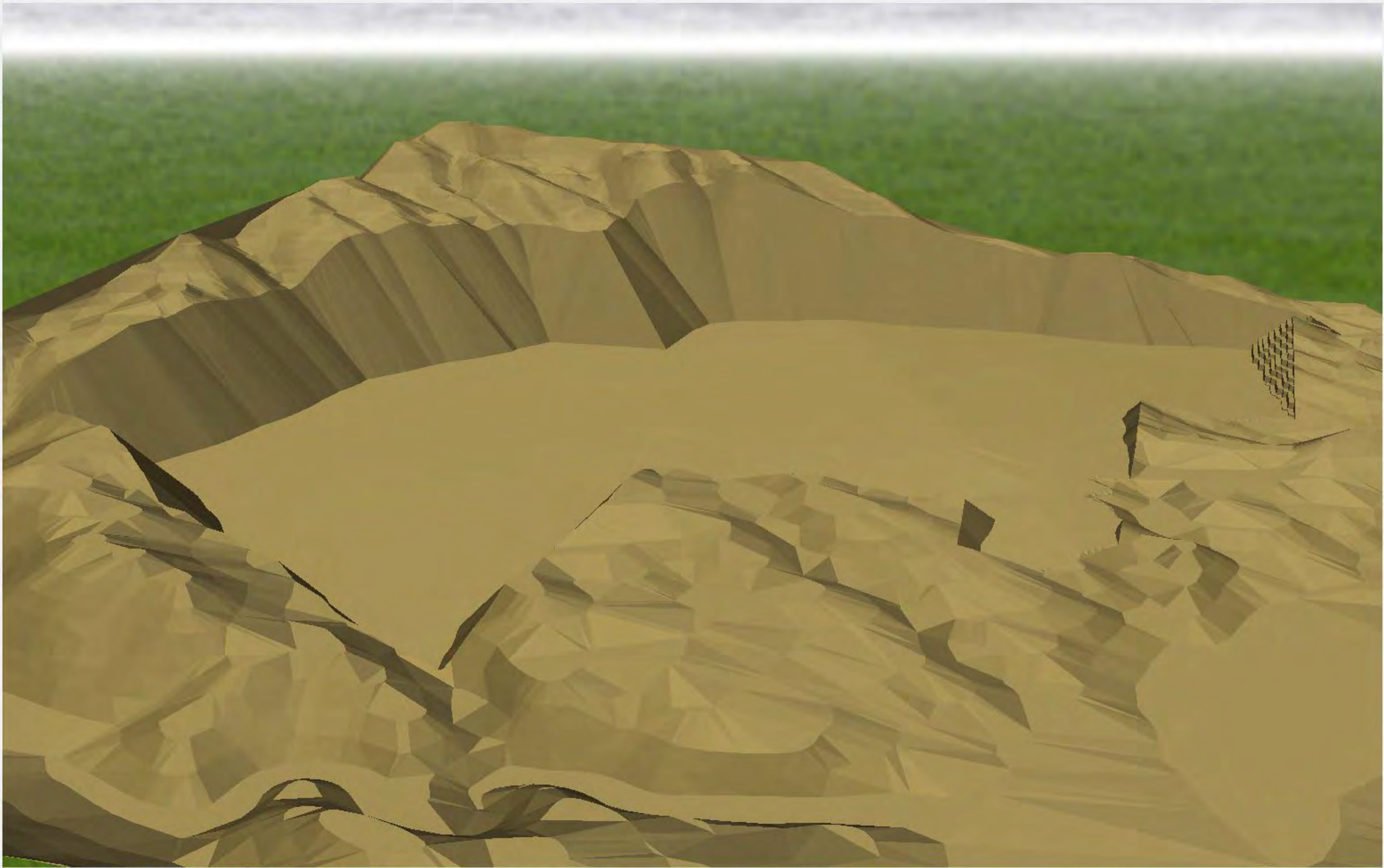

# Appendix D Part 2

# Mine and Reclamation Plan Supplemental Information

**MARTIN MARIETTA MINE AND RECLAMATION PLAN SUMMARY**

**COC-078119**

1/15/2020

| BLM Required Information | Martin Marietta Materials, Inc. Information | MAP/Figure Provided | Enough Info for Analysis | Additional Info Needed Prior to Contract authorization |
|---|---|---|---|---|
| **1. General Information** | | | | |
| a. Operator information | Martin Marietta Materials, Inc., Rocky Mountain Division, 1627 Cole Blvd., Suite 200, Lakewood, CO 80401 | - | X | - |
| b. Location | The Parkdale Quarry is located in Fremont County, Colorado, approximately 12 miles west of the Town of Canon City, Colorado. The Parkdale Quarry is situated on the north side of the Arkansas River, and north of U.S. Highway (US) 50 in portions of Sections 11, 12, 13, and 14, Township 18 South, Range 72 West, Sixth Prime Meridian. Martin Marietta proposes to expand operations generally north onto BLM property in portions of Sections 1, 2, 11, and 12, Township 18 South, Range 72 West, Sixth Prime Meridian (the Mineral Materials Sale Area). | X | X | - |
| c. Surface and mineral rights ownership | BLM managed surface and minerals. | - | X | - |
| d. Easements, Right-of-Ways, existing structures, etc. | There will be no structures within 200 feet of the proposed mineral materials sales area. | - | X | - |
| e. Schedule - Seasonal and daily hours of operation and shifts | 100-year mine life. Mining and processing limited to daylight periods only. 24-hour loading of material for transport by rail cars and trucks. Phase 1 would have Two 10-hour shifts (one material production shift and one equipment maintenance shift) and Phases 2-5 would have Three overlapping 10-hour shifts (two material production shifts and one equipment maintenance shift). | - | X | - |
| **2. Mine Site** | | | | |
| a. Mine method and direction | Surface hardrock mining using benched working face. Mining direction, generally northwest to southeast. | X | X | - |
| b. Facilities (buildings, scales, wash areas, hazardous materials storage, tank farms, restrooms, smoking area, etc.) | There will be no structures within the proposed mineral materials sales area. All structures will remain within the privately owned area and are covered under the current permits for the site. (Map included as SWMP Fig. 2, 1/22/19) | X | X | - |
| c. Man-made structures (culverts, bridges, portals, etc.) | There will be no structures within the proposed mineral materials sales area, other than possibly culverts. All structures will remain within the privately owned area and are covered under the current permits for the site. (Map included as SWMP Fig. 2, 1/22/19) | X | X | Location of culverts for road construction, as applicable. |
| d. Geology and deposit thickness and consistency | The deposit consists of Precambrian granite. Some veins of gabbro were observed during the exploratory drilling, and are expected to comprise less than 5% of the deposit. The deposit is within a plutonic rock body and the deposit thickness is in excess of 300 feet. | - | X | - |
| e. Geotechnical stability | Slope stability is addressed in the CDRMS permit (*Slope Stability Report Sand and Gravel Mining Operation for Parkdale Quarry*; Applegate Group, Inc. January 2008; *Parkdale Quarry Slope Stability Summary*, Lyman Henn Inc. January 2008). The BLM proposed mineral materials sale is contiguous with, is part of the same rock body as, and extends mining of the currently permitted deposit. Geotechnical stability for pit design is already addressed in the slope stability report submitted as part of the existing permit. | - | X | Clarification from certified professional that no additional information needed. |
| f. Communications system | The existing radio communication system will continue to be used for the proposed mineral materials sales area. | - | X | - |
| g. Utilities (include installation and upgrades, as applicable) | Black Hills is currently upgrading the power to the area, including the mine. Martin Marietta Materials is paying a portion of the costs for that upgrade whether the proposed action is approved, or not. The upgrade is independent of the proposed action, though a material processing plant sized to accommodate the anticipated additional production associated with the proposed action would require significantly more power than a plant designed only to process resources on Martin Marietta-owned lands. | - | X | - |

| BLM Required Information | Martin Marietta Materials, Inc. Information | MAP/Figure Provided | Enough Info for Analysis | Additional Info Needed Prior to Contract authorization |
|---|---|---|---|---|
| h. Proximity to waterways | Current Creek is located within the western buffer area of the proposed sale area. Tallahassee Creek runs through the existing mine footprint on private. The southern portion of the proposed sale area is approximately 0.7 miles north of the Arkansas river. | - | X | - |
| i. Approximate depth of water table, if known | The depth to ground water could not be determined in the borings from the exploration effort, due to the extremely low water yields in the granite. However, based on the observation borings, the depth to groundwater is location specific and variable. A specific number is difficult to arrive at because fractures exposed at the surface become saturated due to precipitation and runoff, so it is difficult to determine what the source of the observed water is. | - | X | - |
| j. Surface water controls | The current operation is covered under Colorado Permit No. COG500325 for stormwater. This permit will be updated as needed, if the proposal moves forward. | X | X | Need modified SWMP and maps |
| k. Documented outfalls (point source discharge to surface waters) | Five outfalls located along the perimeters of the existing permit boundary on private are currently monitored and sampled in accordance with State of Colorado requirements. (Map included as SWMP Fig. 2, 1/22/19) | X | X | - |
| l. Safety controls | The current mine plan incorporates multiple safety controls and demonstrates compliance with MSHA requirements. Some general practices include controlled public access and routine safety meetings. Martin Marietta also follows a Guardian Angel Safety Program. | X | X | - |
| m. Signage | The mine site has signage for traffic rules, public information and safety warnings that all demonstrates compliance with MSHA requirements. A sign is also posted at the entrance of the mine site that includes the operator name and CDRMS permit number. | X | X | - |
| **3. Access** | | | | |
| a. Road construction | The haul road running along the southern and southwestern boundary of the Mineral Materials Sale Area will be constructed prior to the commencement of mining as the main haul road serving the area. The main haul road will lead from the material processing facilities on the Martin Marietta owned portion of the quarry. The main haul road will remain in place throughout the life of the mine. Semi-permanent and temporary haul roads will be constructed to bring material from the pit areas to the main haul road. Haul roads will be constructed in a manner that allows for safe movement and sound performance of vehicles, as warranted by the conditions encountered in a particular location. In general, haul roads will have an approximate six-inch thick fine gravel surfaced wearing course over approximately nine inches of coarse crushed rock, which will in turn sit on approximately 18 inches of compacted aggregate base over the native subgrade unless conditions dictate that an alternate road section will meet safety and performance objectives. Haul roads will generally be at least 60 feet in width to provide ample room for vehicles to safely pass each other. Maximum grades on the haul roads will generally be 10-percent or less, and roads will be designed with a 2-percent cross fall to facilitate drainage. Horizontal curves will generally be designed with a radius of at least 150 feet and will be designed with approximately 10-percent super elevation to safely accommodate anticipated travel speeds. Vertical curves will be flat enough to allow for safe braking distances by loaded haul trucks to avoid obstruction in the travel way. | X | X | - |
| b. Berm construction | Haul roads will be bordered by berms, the height of which will be at least as high as the axle on the largest piece of equipment expected to use the road. These will be constructed in accordance with MSHA requirements. | - | X | - |
| c. Security - Fencing, gates, signage, guard | Site access and security will remain the same as the current mine. The access road is directly off of Hwy 50 on the north side. The access includes a bridge across the Arkansas River and a cross over the railroad tracks. The entrance to the mine site has a gate that can be closed as needed. There is also an office for checking into and a scale house. Signage and fencing may be installed, if needed, in areas involved with the proposed sale area. | - | X | - |
| d. Surface water controls | The current operation is covered under Colorado Permit No. COG500325 for stormwater. This permit will be updated as needed, if the proposal moves forward. (Map provided, but only for existing operation). | X | X | Need modified SWMP and maps |
| **4. Mining Operation** | | | | |

| BLM Required Information | Martin Marietta Materials, Inc. Information | MAP/Figure Provided | Enough Info for Analysis | Additional Info Needed Prior to Contract authorization |
|---|---|---|---|---|
| a. General overview of process | Mining activity would progress under five phases over approximately 100 years, from west and northwest to southeast. | X | X | - |
| b. Operations, production rates and mining methods | Excavation of mineral materials using explosives and/or heavy duty excavation equipment; Loading of mineral materials onto haul trucks and/or an overland conveyor system for transport to the processing facilities on the adjacent private land. Anticipated production rate is approximately 4-million tons/year. | - | X | - |
| c. Blasting Program | All blasting conducted shall be done in accordance with appropriate industry standards and as prescribed by the Mine Safety and Health Administration. All blasting shall be conducted between the hours of 10:00 a.m. to 5:00 p.m.. The blasting shall not occur more than five times per week. All explosive work on the site will be performed by a licensed third party blaster. The explosives needed for each blast will be transported to the site immediately before blast holes are loaded and excess explosives will be removed from the site after the blast holes are loaded. No explosives will be stored on site BLM property. | - | X | - |
| d. Mine geometry, design and composition - Bottom elevation, working slopes, benches (production and interim reclamation), soil and rock type | The deposit consists of precambrain granite. Some veins of gabbro were observed during the exploratory drilling, and are expected to comprise less than 5% of the deposit. The deposit is within a plutonic rock body and the deposit thickness is in excess of 300 feet. It is expected that the excavated pit sides and bottom will be comprised of the granite. Two types of mining benches will be created during the mining process, production benches and reclamation benches. The production benches are those created during the active mining process, the face of which is the source of the mined materials. Reclamation benches are those which remain when mining is completed, and are generally located at the mining disturbance boundary. Production benches will not exceed 70 feet in height, have a face angle anticipated to be approximately 80 degrees, and a width of not less than 40 feet. Temporary safety berms will be constructed parallel to and at the top edge, and ten feet from the base of production benches that are not actively being mined. | X | X | - |
| e. Stationary, mobile and processing equipment. Provide the following - 1) Year, make, model; 2) Function in the mining operation; 3) Special accommodations (white noise backup alarm, lighting, scrubber, etc.) | All equipment information provided as part of the air quality data submission process. | - | X | - |
| f. Development activities | The haul road used to transport mined materials to Martin Marietta's property for processing will be constructed prior to the commencement of Phase 1 mining. We anticipate that Phase 1 of the mining process will disturb approximately 81 acres over a period of 15 to 20 years in the area designated as the West Pit. Phase 2 mining will disturb approximately 166 acres over an estimated period of 20 to 40 years in the area designated as the West Central Pit. We estimate that Phase 3 will disturb approximately 228 acres over a period of 25 to 50 years in the area designated as the Central Pit. The Phase 4 will disturb approximately 110 acres over an estimated 15 to 30 year period in the area designated as the East Central Pit. Phase 5 mining will disturb approximately 113 acres in the area designated as the East Pit, and will take an estimated 15 to 25 years. | X | X | - |
| g. Topsoil stripping, stockpiling and stabilizing | Overburden and topsoil will be stripped from areas to be mined by the use of conventional heavy earthmoving equipment. Overburden and topsoil will be placed in stockpiles for reuse during the reclamation process. Overburden and topsoil stockpiles that will not be used within six months of excavation will be seeded to establish a vegetative cover from stabilization and protection from erosion. The applicant has committed to test an admixture of plant fines and topsoil. The results from such tests will be reviewed jointly by the applicant and the Division of Wildlife [this will also include CDRMS and BLM]. If appropriate and suitable, the applicant will then augment the available topsoil with such fines but only if it will be successful as a growth media. | - | X | Need modified SWMP and maps; modified APEN for fugitive dust |

| BLM Required Information | Martin Marietta Materials, Inc. Information | MAP/Figure Provided | Enough Info for Analysis | Additional Info Needed Prior to Contract authorization |
|---|---|---|---|---|
| h. Overburden stripping, stockpiling and stabilizing | Aggregate materials will be excavated from the Mineral Materials Sale Area by using explosives to free the rock from the matrix. Once the aggregate material is blasted free of the rock matrix, a loader or excavator will be used to handle and load it into off-road dump trucks and/or onto a conveyor for transport to the material. processing area on the adjacent Martin Marietta-owned property. Blocks of rock that are too large to process (oversize material) or that will not be used as riprap will be temporarily set aside adjacent to the excavation site for mechanical size reduction. An excavator equipped with a mechanical breaker or other mechanical means will be used to reduce oversized material to an appropriate size for transport and processing. | - | X | Need modified SWMP and maps; Need dust control plan to be modified and provide a revised APEN for new operations. |
| i. Development rock processing and stockpiling | Aggregate materials will be excavated from the Mineral Materials Sale Area by using explosives to free the rock from the matrix. Once the aggregate material is blasted free of the rock matrix, a loader or excavator will be used to handle and load it into off-road dump trucks and/or onto a conveyor for transport to the material. processing area on the adjacent Martin Marietta-owned property. Blocks of rock that are too large to process (oversize material) or that will not be used as riprap will be temporarily set aside adjacent to the excavation site for mechanical size reduction. An excavator equipped with a mechanical breaker or other mechanical means will be used to reduce oversized material to an appropriate size for transport and processing. | - | X | - |
| j. Approximate percent of process and overburden waste rock generation | | - | X | Need waste % for PV. |
| k. Grading plan | General information is provided in the mine plan. | | X | Finalized grading map, incorporating drainages, after coordination with CDRMS. |
| l. Excavation, stockpiling and earthwork balance for surface structures | Surface structures are already in place on private land for existing mine. | X | X | - |
| m. Geochemistry of Ore, Waste Rock and Peripheral Rock, if potential concern | This is an aggregate quarry mining a relatively homogenous granite deposit, not a metals mine or coal mine. Sulfide minerals have not been identified in the deposit in the mining area. Acid rock discharge does not apply. | - | X | - |
| n. Mine backfill, as applicable | N/A | - | - | - |
| o. Treatment and Containment Plan for Mine Related Material (i.e. tailings pond, as applicable) | Treatment is not proposed, other than physical processing. | - | X | - |
| p. Development rock conveyance and transport, both onsite and off | Loading of mineral materials onto haul trucks and/or an overland conveyor system, possibly in the future, for transport to the processing facilities on the adjacent private land. If a conveyor system is used in the future, it would resemble the current one used at a nearby Martin Marietta Materials quarry. | - | X | - |
| q. Processing operations (primary crusher, secondary crusher, etc.) | Loading of mineral materials onto haul trucks and/or an overland conveyor system for transport to the processing facilities on the adjacent private land. | X | X | - |
| r. Additional processes onsite (batch plant, washplant, etc.) | All processing will continue to take place on private land. | X | X | - |
| s. Interim reclamation | Interim reclamation will consist of ongoing reclamation in this proposal. Those details are located in Section 8 below. | - | X | - |
| **5. Management Practices** | | | | |
| a. Containers and tanks | Containers, tanks and other materials and waste storage structures will continue to only be used on private land. | X | X | Provide any updated practices, as applicable. |

| BLM Required Information | Martin Marietta Materials, Inc. Information | MAP/Figure Provided | Enough Info for Analysis | Additional Info Needed Prior to Contract authorization |
|---|---|---|---|---|
| b. Fuel handling and chemical usage (Spill Response Plan) | Currently there is an Oil Spill Contingency Plan and SPCC in place. These will apply to the proposed sale area, as applicable. | X | X | Provide any updated plans, reporting processes and practices, as applicable. |
| c. Blasting materials handling and storage | All blasting will be conducted by a 3rd party. | - | X | - |
| d. Spill prevention, control and countermeasures plan, if applicable | Currently there is an Oil Spill Contingency Plan and SPCC in place. These will apply to the proposed sale area, as applicable. | | X | - |
| e. Solid &/or hazardous waste | There will be no solid or hazardous waste generated or stored in the proposed mineral material sales area. | - | X | - |
| f. Hazardous substances | There will be no hazardous substances stored in the proposed mineral material sales area. | - | X | - |
| g. Weeds | Martin Marietta will continue to administer the management plan for the control of undesirable or noxious plants or weeds, as per recommendation of the Fremont County Weed Control Officer and the Natural Resources Conservation Service. The Fremont County weed control specialist comes in and sprays at least once a year, typically in the spring. We also try to make sure that vehicles entering the site are clean so as not to transport weed seeds onto the site. There is a leafy spurge and weed control plan currently in place for the active mine. These measures will be applied to the proposed sale area. | - | X | Provide updated plans and practices, as applicable. |
| h. Sanitary system | No permanent change to the current sanitation system is proposed for BLM land or as a result of the proposal. The active mine on private land utilizes portalets (pumped 1-2 times per week), which at some point may be upgraded to a septic system in the future, in accordance with applicable regulations. If needed, portalets may be utilized in the BLM sale area on a temporary basis. | X | X | - |
| i. Stockpiles - topsoil, product, overburden/waste material, process waste rock | Approach to stockpiling is provided in the mine plan. Locations of piles are not provided but likely not needed for the EIS. No waste rock anticipated. | | X | |
| j. Additional material used for blending | No blending material is currently needed to be used or stored at Parkdale. If in the future material is brought in, it would most likely be stored on the private land in the processing area. | - | X | - |
| k. Roads & berms | A drainage ditch will run along the downhill side of the haul road. Temporary safety berms will be constructed parallel to and at the top edge, and ten feet from the base of production benches that are not actively being mined, in accordance with MSHA requirements. Haul roads will be watered regularly to control dust, and will also be treated with a chemical dust suppressant such as calcium or magnesium chloride. | X | X | - |
| l. Water usage, treatment and discharge | No substantial difference in water usage will occur with proposed sale area. Water will continue to be pumped locally in accordance with an existing substitute water supply plan. It is estimated that 1500 gpm will be used daily, with 10 gpm of that be consumptive use. Discharge is described in SWMP. | X | X | Need to consult with CDWR for clarification on permits needed; Need modified SWMP and maps. |
| m. Wastewater sources, treatment and discharge | Not applicable. | - | X | - |
| n. General housekeeping | All practices will be the same as what is done now. | - | X | - |
| o. Interim management plan during shutdown periods | Management and monitoring during temporary shutdowns would adhere to all permits and authorizations currently in place. | - | X | - |
| p. Administrative policies affecting mine site and regional resources (training, onsite fire & EMT response, shift work, etc.) | | - | X | Applicable policies for training, etc. may be needed. |

| BLM Required Information | Martin Marietta Materials, Inc. Information | MAP/Figure Provided | Enough Info for Analysis | Additional Info Needed Prior to Contract authorization |
|---|---|---|---|---|
| **6. Compliance** (Provide all Federal, State and local regulatory permits that will be required) | | | | |
| Reclamation Permit (CDRMS) | In place, would require amendment. | | | |
| MSHA | In place, amended as needed. | | | |
| Air (CDPHE) | In place, would require amendment. | | | |
| Water quality (CDPHE) | In place, would require amendment. | | | |
| Water quantity, surface and groundwater (State of Colorado) | In place, would require amendment. | | | |
| Oil spills prevention and preparedness (CDPHE/EPA) | In place, amended as needed. | | | |
| 404 Clean Water Act (USACE) | No dredging or filling of Waters of the US are proposed. | | | |
| Blasting/explosives (CDOPS/ATF) | In place, amended as needed. | | | |
| Any other regulatory requirement applicable to the operation | | | | |
| **7. Quality Assurance/Quality Control** | | | X | |
| a. Active mining monitoring plans - 1) Air quality, water quality, water quantity, noise, weeds, interim reclamation, and others as applicable; 2) Tanks, facilities, equipment, security structures, and others as applicable | Typically part of existing permit/authorities. | - | X | Provide BLM with a current monitoring protocol that reflects all amendments. |
| b. Interim (temporary cessation and/or seasonal shutdown) monitoring plans | Management and monitoring during temporary shutdowns would adhere to all permits and authorizations currently in place. | - | X | |
| c. Post-closure monitoring | Monitoring will be adequate to ensure final reclamation is established in accordance with BLM (Appendix E and requirements resulting from this analysis), CDRMS and Fremont County requirements. | - | X | Additional criteria will be provided to BLM after coordination with CDRMS and Fremont County. |
| **8. Interim & Final Reclamation** | | | | |
| a. Sequence and timing | The generalized post-mining topography and a three dimensional rendering of general landscape at the end of mining each phase is shown on the mine plans for each phase. The three dimensional renderings also help to demonstrate how visual impacts are minimized by using topographic features. Each mine phase will be substantially completed before the next is started. Reclamation activities will begin in a particular part of a pit area when mining is complete in that part of the pit area, and there is no longer a need to access it. Thus, reclamation will be occurring concurrently with mining, in order to minimize the total disturbed acreage. | X | X | - |
| b. Final land use and composition | The Mine Plan provides an overview of reclamation processes. The private land is currently identified as an end land use of water storage. The BLM land would have an end use of range land. | - | X | - |
| c. Removal of structures | All major structures would remain on private land. Other things such as fencing and signs would be removed and disposed of appropriately. | - | X | - |
| d. Access roads/trails | All new access roads on BLM would be reclaimed. | - | X | - |

| BLM Required Information | Martin Marietta Materials, Inc. Information | MAP/Figure Provided | Enough Info for Analysis | Additional Info Needed Prior to Contract authorization |
|---|---|---|---|---|
| e. Benches & slopes | Reclamation benches will be approximately 35 feet high, have a bench width of approximately 30 feet, and a face angle of approximately 80 degrees, resulting in an overall approximate 1:1 (horizontal to vertical) reclamation slope. Reclamation of individual benches will be accomplished by regrading and/or backfilling benches to an approximate 1:1 (horizontal to vertical) reclamation slope to generally blend with the surrounding topography. The actual bench geometry selected will be that which provides a minimum static factor of safety of 1.3, based on rock slope stability analysis. Some areas of bare rock will remain as bare rock and reclamation of areas of bare rock will be limited to that practical for minimizing obvious disturbance. Based on conversations with the Colorado Department of Parks and Wildlife staff, we anticipate leaving some parts of some mining benches with near vertical slopes, as they mimic topography that serves as escape habitat for bighorn sheep to avoid predators. Benches will be backfilled as final mining is completed, and fill will be placed using a bulldozer to grade and compact slope fill material. A generalized cross-section showing the reclaimed bench geometry is presented on Figure 4. | X | X | - |
| f. Grading | Valley Floor: The Mineral Materials Sale Area currently drains to the south and southwest, with the majority of the runoff from the area flowing to Current Creek and Tallahassee Creek through three main drainage areas, as shown on Figure 7, the Parkdale Expansion Topographic Map. Once mining is completed, the topography of the valley floor created in the mining process will generally slope to the southwest and south, as shown on Figure 8, the Parkdale Expansion Proposed Mine Plan. Drainage channels will be excavated into the valley floor that connect to the three existing main drainages outside the Mineral Materials Sales Area. The drainage channels will be laid out so as to continue to generally direct water from the areas currently draining to the main drainage areas. A conceptual layout for the drainage channels is presented on Figure 9. The drainage channels will be constructed with a depth, cross-section, and sinuosity similar to that of the natural drainages in Webster Park *[area south of Hwy 50]* that feed into the south side of the Arkansas River. Some side drainages will be constructed to better capture and direct runoff within the Mineral Materials Sale Area. | X | X | Finalized grading and reclamation maps, incorporating drainages, after coordination with CDRMS. |
| g. Soil stabilization and revegetation | * Heavily compacted soil surfaces will be ripped to depths varying from 6 to 12 inches, depending upon the degree of compaction prior to the replacement of topsoil. Based on the adjacent Parkdale Quarry, the existing topsoil depth in the Mineral Materials Sale Area generally ranges from 0 inches to 18 inches. Replacement topsoil depths comparable to those prior to mining, or an average of 9 inches evenly placed, will be used. Prior to reseeding of disturbed areas, topsoil will be placed to achieve a generally uniform thickness; minimize compaction and erosion; and preserve biological, physical, and chemical properties. Where practical, soil will be applied so as to minimize grading requirements and compaction from multiple equipment passes over the area being reclaimed. Final grading will generally be completed parallel to the topographic contour of the area, where safety conditions permit, to minimize erosion and maximize site stability. Ideally, soil will be applied on areas to be seeded less than 30 days prior to seeding.<br>* Within five days after the application of fertilizer, but prior to seeding, the topsoil will be prepared for seeding by utilizing a disk, harrow or chisel plow to roughen the surface, depending upon site conditions and availability. The topsoil surface will then be left in a roughened condition to inhibit erosion and provide a receptive surface for subsequent reclamation procedures. * Prior to reseeding of disturbed areas, samples will be collected to ascertain fertilizer application concentration. * Seed mixtures provided (with details on application rates and seed supply sources) specific to stockpiles, roads and quarry floors, and benches. Broadcast method. * Mulching will be conducted immediately following seeding operations, where deemed necessary at the time of application to meet reclamation objectives. | - | X | X |
| h. Cost estimate (for locatable operations only) | N/A - The reclamation cost estimate will be jointly calculated by CDRMS and BLM. | - | X | - |

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*Draft Environmental Impact Statement*
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# *Appendix E*

BLM RGFO Solid Minerals
Final Reclamation Standards

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# BLM RGFO Solid Minerals FINAL Reclamation Standards

***Date*** ***BLM POC*** ***Site Name/COC#*** ***Operator***

- It is the operator’s responsibility to monitor the site and take the necessary steps to ensure reclamation success.
- Reclamation is considered complete by BLM once the following standards have been achieved, as applicable, and in accordance with the authorized Reclamation Plan on file.
- BLM RGFO will inspect the location of the mining and/or exploration operations to ensure all final reclamation requirements have been achieved before the release of a reclamation or performance bond.
- Coordination between BLM and the Colorado Division of Reclamation, Mining and Safety and/or other applicable agencies is required, prior to release of a reclamation or performance bond.

| | **Item** | **Item Description** | **Applicable** | **Complete** | **Not Complete** | **If not complete, what is still needed** |
|---|---|---|---|---|---|---|
| **Highwall Reclamation** | *Benches* | All benches are established with final reclamation dimensions and slopes. | | | | |
| | | No raveling or fracturing is evident. | | | | |
| | | Tailored rock placement complete. | | | | |
| | *Water Drainage* | Positive Drainage design established. | | | | |
| | | No standing water present following a representative precipitation event. | | | | |
| | *Vegetation* | Adequate vegetation coverage is typically considered sufficient when a self-sustaining, vigorous, diverse, native (or otherwise approved), desirable plant community is established throughout the benches, in accordance with reclamation and safety requirements outlined in the reclamation plan. | | | | |
| | | Regrowth percentage is sufficient to control erosion and noxious weed invasion and support re-establishment of wildlife habitat or forage production. | | | | |
| | *Noxious Weed Control* | Disturbed area is free of State and County Class A & B noxious weeds. | | | | |

| | Item | Item Description | Applicable | Complete | Not Complete | If not complete, what is still needed |
|---|---|---|---|---|---|---|
| **Structure Reclamation** | *Borehohole Abandonment* | All boreholes are abandoned in accordance with State of Colorado requirements. | | | | |
| | | Abandonment reports are filed with State of Colorado and copied to BLM. | | | | |
| | | There is no visible casing: either completely removed or cutoff at a minimum of 2-feet below the surface. | | | | |
| | | The abandoned borehole surface area is regraded and has established vegetation[1]. | | | | |
| | *Monitoring Well Establishment* | All wells are constructed and developed in accordance with State of Colorado requirements. | | | | |
| | | Coordination with RGFO water/well POC completed. | | | | |
| | | All permits are filed with the State of Colorado and copied to BLM. | | | | |
| | | Surface casing is locked. | | | | |
| | | There is a concrete pad, bollard posts or similar features completed on the surface to protect well integrity. | | | | |
| | | The surface area around the well is regraded and has established vegetation[1]. | | | | |
| | *Adit and/or Shaft Closures* | No trash, debris, metal, timber, wire or other mining related materials are present. | | | | |
| | | Adits and/or shafts are plugged in accordance with the Reclamation Plan. | | | | |
| | | Plugged material is covered and compacted with a natural impervious material (e.g. clay) | | | | |
| | | The finished surface of adits and/or shafts are graded, which provides positive drainage away from the openings. | | | | |
| | | Established vegetation[1] in areas around the shafts and/or adits. | | | | |
| | *Removal* | All equipment, blasting materials, and man-made structures are removed from the site. Evidence of final disposition provided. | | | | |
| | | All mining related waste and demolition materials disposed of offsite, in accordance with applicable laws. Evidence of final disposition provided. | | | | |

| | Item | Item Description | Applicable | Complete | Not Complete | If not complete, what is still needed |
|---|---|---|---|---|---|---|
| **Surface Reclamation** | *Stockpiles and Berms* | All product and overburden stockpiles, concentrates and road/stormwater berms are recontoured and spread throughout the site. | | | | |
| | *Recontour & Regrade* | The mined area, working floor, access road(s) and all other disturbances are recontoured and/or regraded to mimic the surrounding natural topography, prior to the establishment of the mining operation. | | | | |
| | *Topsoil & Amendments* | Topsoil is spread throughout disturbed areas and amended as needed. | | | | |
| | | Measurements of topsoil depths are documented and, at a minimum, equal to depths stated in reclamation plan. | | | | |
| | *Vegetation* | Established vegation[1]. | | | | |
| | *Noxious Weed Control* | Density less than or equal to area outside the authorized mine ops perimeter. | | | | |
| | | Disturbed area is free of State and County Class A & B noxious weeds. | | | | |
| | *Water Drainage* | Positive Drainage design established. | | | | |
| | | Water drainage follows the surrounding natural drainage patterns and topography. | | | | |
| | | No standing water is present longer than 72 hours. | | | | |
| | *Surface Stability* | Comparable to area outside the authorized mine ops perimeter. | | | | |
| | | No evidence of atypical gullying, headcutting, slumping and/or deep and excessive rilling. | | | | |

[1] Established vegetation is defined as:

1. Adequate vegetation coverage is typically considered sufficient when a self-sustaining, vigorous, diverse, native (or otherwise approved), desirable plant community is established throughout all disturbed areas. BLM will evaluate the vegetation conditions using the Daubenmire Method.
2. Attainment of approximately 70% or more native plant foliar cover. If pre-disturbance conditions indicate that the 70% native plant species foliar cover criterion may be difficult to achieve post-reclamation, the AO has discretion to adjust this percentage.
3. Regrowth percentage is sufficient to control erosion and noxious weed invasion and support re-establishment of wildlife habitat or forage production.
4. A minimum of two growing seasons, with a self-sustaining upward trend in native plant species foliar cover.
5. Absence of non-native invasive plant species above baseline (i.e. non-native invasive species are no greater than the pre-mining conditions or surrounding area).
6. The AO may consider alternative (non-vegetative) wildlife habitat features as a partial substitute for foliar cover.

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# *Appendix F*

## Water Resources Supporting Information

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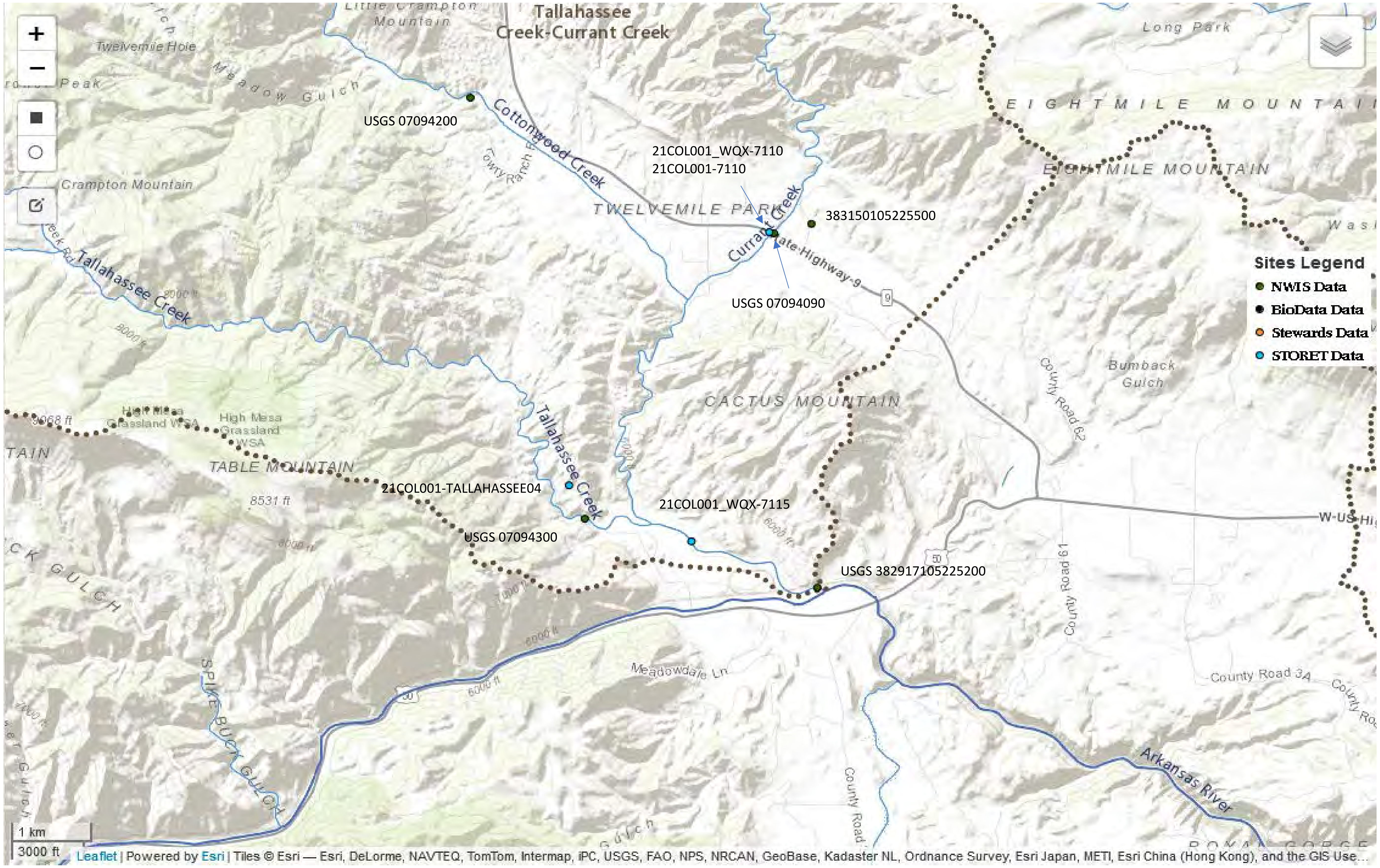
Station Locations



## Station Information

| Organization | Station ID | Location | Type | Latitude | Longitude | Coordinate Ref. | Elevation (ft) | Formation | Construction Date | Depth (ft) | Data Source |
|---|---|---|---|---|---|---|---|---|---|---|---|
| USGS | USGS-07094090 | CURRANT CREEK AB COTTONWOOD CR NR PARKDALE, CO. | Stream | 38.5294404 | -105.388 | NAD83 | 6160 | | | | NWIS |
| USGS | USGS-07094300 | TALLAHASSEE CREEK AB CURRANT CR NR PARKDALE, CO. | Stream | 38.4961076 | -105.414 | NAD83 | 5880 | | | | NWIS |
| USGS | USGS-382917105225200 | TALLAHASSE CREEK NEAR PARKDALE, CO | Stream | 38.4880522 | -105.382 | NAD83 | 5740 | | | | NWIS |
| USGS | USGS-383150105225500 | SC01707130CCC | Well | 38.5305514 | -105.382 | NAD83 | 6800 | Dakota Sandstone | 19680101 | 628 | NWIS |
| CDPHE | 21COL001-7110 | CURRANT CK @ HWY 9 | River/Stream | 38.5295833 | -105.388 | NAD83 | | | | | STORET |
| CDPHE | 21COL001-7115 | TALLAHASSEE CREEK NR MOUTH | River/Stream | 38.4934666 | -105.399 | NAD83 | 5829 | | | | STORET |
| CDPHE | 21COL001-TALLAHASSEE04 | TALLAHASSEE CREEK | River/Stream | 38.5 | -105.417 | UNKWN | | | | | STORET |
| CDPHE | 21COL001_WQX-7110 | CURRANT CK @ HWY 9 | River/Stream | 38.529583 | -105.388 | NAD83 | | | | | STORET |
| CDPHE | 21COL001_WQX-7115 | TALLAHASSEE CREEK NR MOUTH | River/Stream | 38.493467 | -105.399 | NAD83 | | | | | STORET |
| USGS | USGS-07094200 | COTTONWOOD CREEK AB SAND GULCH NR PARKDALE, CO. | Stream | 38.5452734 | -105.431 | NAD83 | 6300 | | | | NWIS |

Cottonwood Creek

| **Station Number**<br>**Date** | | | **7094200**<br>**1/13/1981** | **7094200**<br>**5/1/1981** | **7094200**<br>**6/3/1981** | **7094200**<br>**6/17/1981** | **7094200**<br>**7/17/1981** | **7094200**<br>**8/4/1981** |
|---|---|---|---|---|---|---|---|---|
| Alkalinity Total | Total | mg/l CaCO3 | | | | | | |
| Alpha emitting radium isotopes | Dissolved | pCi/L | <0.1 | <0.1 | | <0.1 | <0.1 | 0.2 |
| Alpha particle | Dissolved | pCi/L | 29 | 33 | 29 | | 26 | 12 |
| Alpha particle | Dissolved | ug/l | 43 | 49 | 43 | | 38 | 18 |
| Alpha particle | Suspended | pCi/L | 1.2 | <0.3 | 4.1 | 0.3 | <0.3 | 0.6 |
| Alpha particle | Suspended | ug/l | 1.7 | <0.4 | 6.1 | 0.4 | <0.4 | 0.9 |
| Arsenic | Dissolved | ug/l | 2 | 1 | 2 | 1 | 1 | 1 |
| Barium | Dissolved | ug/l | 100 | 300 | 100 | 0 | 100 | 200 |
| Beta particle | Dissolved | pCi/L | 12 | 14 | 11 | 6.9 | 9.7 | 13 |
| Beta particle | Dissolved | pCi/L | 11 | 13 | 10 | 6.6 | 9.3 | 12 |
| Beta particle | Suspended | pCi/L | 3.2 | 0.5 | 6.7 | 0.4 | 0.9 | 2.4 |
| Beta particle | Suspended | pCi/L | 3 | 0.5 | 6.4 | 0.4 | 0.9 | 2.3 |
| Cadmium | Dissolved | ug/l | 0 | 0 | 0 | <10 | <10 | <10 |
| Carbon dioxide | Total | mg/l | | | | | | |
| Chloride | Dissolved | mg/l | 33 | 48 | 49 | 47 | 42 | 45 |
| Chromium | Recoverable | ug/l | 15 | 2 | 6 | 3 | 3 | 11 |
| Gross-Uranium | Dissolved | ug/l | 30.5 | 29 | 24 | 18 | 23 | 23 |
| Hydrogen ion | Total | mg/l | <0.001 | <0.001 | 0.00001 | 0.00001 | 0.00002 | 0.00001 |
| Lead | Dissolved | ug/l | <100 | 0 | 0 | <100 | <100 | <100 |
| Oxygen | Dissolved | mg/l | 12.1 | 7.1 | 7.4 | 7.1 | 6.7 | 7.1 |
| pH | Total | std units | 8.4 | 8.4 | 8.3 | 8.1 | 7.7 | 8 |
| pH | Total | std units | 8.2 | 8.4 | 8.4 | 7.8 | 8.4 | 8.4 |
| Selenium | Dissolved | ug/l | 1 | 1 | 0 | 0 | 0 | 0 |
| Silver | Dissolved | ug/l | 0 | 0 | 1 | 0 | 0 | 0 |
| Specific conductance | Total | uS/cm @25C | 771 | 756 | 754 | 788 | 765 | 795 |
| Specific conductance | Total | uS/cm @25C | | 772 | 755 | 795 | 750 | 790 |
| Stream flow, instantaneous | | ft3/s | 1.4 | 0.7 | 5 | 0.62 | 0.03 | 0.1 |
| Stream flow, instantaneous | | m3/sec | 0.04 | 0.02 | 0.14 | 0.02 | 0 | 0 |
| Sulfate | Dissolved | mg/l | 69 | 60 | 59 | | 77 | 23 |
| Temperature, water | | deg C | 1.5 | 22 | 22 | 21 | 22 | 20 |

## Cottonwood Creek

| **Station Number** | | | **7094200** | **7094200** | **7094200** | **7094200** | **7094200** | **7094200** |
|---|---|---|---|---|---|---|---|---|
| **Date** | | | **8/10/1981** | **9/8/1981** | **2/11/1982** | **4/7/1982** | **5/20/1982** | **6/22/1982** |
| Alkalinity Total | Total | mg/l CaCO3 | 76 | | | | | |
| Alpha emitting radium isotopes | Dissolved | pCi/L | 0.7 | 0.1 | <0.1 | <0.1 | 0.1 | <0.1 |
| Alpha particle | Dissolved | pCi/L | 8.8 | 18 | 26 | 25 | 24 | 20 |
| Alpha particle | Dissolved | ug/l | 13 | 27 | 38 | 37 | 35 | 29 |
| Alpha particle | Suspended | pCi/L | 7500 | 3.5 | <0.3 | <0.3 | <0.3 | 1.3 |
| Alpha particle | Suspended | ug/l | 11000 | 5.1 | <0.4 | <0.4 | <0.5 | 1.9 |
| Arsenic | Dissolved | ug/l | | 1 | 1 | 1 | 1 | 1 |
| Barium | Dissolved | ug/l | 100 | 100 | 100 | 100 | 200 | <100 |
| Beta particle | Dissolved | pCi/L | 13 | 16 | 9.1 | 16 | <7.5 | 12 |
| Beta particle | Dissolved | pCi/L | 12 | 15 | 8.8 | 15 | <7.2 | 11 |
| Beta particle | Suspended | pCi/L | 7600 | 6.9 | 1.3 | 0.8 | 3.8 | 2.6 |
| Beta particle | Suspended | pCi/L | 7400 | 6.5 | 1.4 | 0.8 | 3.6 | 2.5 |
| Cadmium | Dissolved | ug/l | 0 | 0 | <10 | <1 | <1 | <10 |
| Carbon dioxide | Total | mg/l | 4.7 | | | | | |
| Chloride | Dissolved | mg/l | 4.7 | 58 | 44 | 53 | 67 | 67 |
| Chromium | Recoverable | ug/l | 190 | 14 | 2 | 3 | 2 | 4 |
| Gross-Uranium | Dissolved | ug/l | 6.4 | 19 | 30 | 26 | 34 | 28 |
| Hydrogen ion | Total | mg/l | 0.00003 | 0.00001 | 0.00001 | <0.001 | 0.00001 | 0.00001 |
| Lead | Dissolved | ug/l | <100 | <100 | <1 | <100 | <1 | <100 |
| Oxygen | Dissolved | mg/l | 8.1 | 6.4 | 9.2 | 8.3 | 8 | 6.8 |
| pH | Total | std units | 7.5 | 8.3 | 8.1 | 9 | 8.2 | 8.1 |
| pH | Total | std units | 7.2 | 8.7 | 8.5 | 8.6 | 8.6 | 8.7 |
| Selenium | Dissolved | ug/l | 0 | 0 | 1 | 1 | 1 | <1 |
| Silver | Dissolved | ug/l | 0 | 0 | 1 | <1 | <1 | <5 |
| Specific conductance | Total | uS/cm @25C | 215 | 826 | 754 | 750 | 835 | 868 |
| Specific conductance | Total | uS/cm @25C | | | | 779 | 828 | 854 |
| Stream flow, instantaneous | | ft3/s | 23 | 1.9 | 0.3 | 2 | 0.92 | 0.82 |
| Stream flow, instantaneous | | m3/sec | 0.65 | 0.05 | 0.01 | 0.06 | 0.03 | 0.02 |
| Sulfate | Dissolved | mg/l | 20 | <5 | 56 | 44 | 32 | 53 |
| Temperature, water | | deg C | 9 | 20.5 | 3 | 13.5 | 20 | 19.5 |

| **Station Number** | | | **7094200** |
|---|---|---|---|
| **Date** | | | **9/21/1982** |
| Alkalinity Total | Total | mg/l CaCO3 | |
| Alpha emitting radium isotopes | Dissolved | pCi/L | 0.2 |
| Alpha particle | Dissolved | pCi/L | 88 |
| Alpha particle | Dissolved | ug/l | 130 |
| Alpha particle | Suspended | pCi/L | <0.3 |
| Alpha particle | Suspended | ug/l | <0.4 |
| Arsenic | Dissolved | ug/l | 1 |
| Barium | Dissolved | ug/l | 100 |
| Beta particle | Dissolved | pCi/L | 33 |
| Beta particle | Dissolved | pCi/L | 32 |
| Beta particle | Suspended | pCi/L | 1 |
| Beta particle | Suspended | pCi/L | 1 |
| Cadmium | Dissolved | ug/l | <1 |
| Carbon dioxide | Total | mg/l | |
| Chloride | Dissolved | mg/l | 71 |
| Chromium | Recoverable | ug/l | <1 |
| Gross-Uranium | Dissolved | ug/l | 30 |
| Hydrogen ion | Total | mg/l | 0.00001 |
| Lead | Dissolved | ug/l | <1 |
| Oxygen | Dissolved | mg/l | 7.2 |
| pH | Total | std units | 8.2 |
| pH | Total | std units | 8.6 |
| Selenium | Dissolved | ug/l | <1 |
| Silver | Dissolved | ug/l | <1 |
| Specific conductance | Total | uS/cm @25C | 872 |
| Specific conductance | Total | uS/cm @25C | 862 |
| Stream flow, instantaneous | | ft3/s | 2.5 |
| Stream flow, instantaneous | | m3/sec | 0.07 |
| Sulfate | Dissolved | mg/l | 43 |
| Temperature, water | | deg C | 18 |

## Currant Creek

| **Station Number**<br>**Date** | | | **7094090**<br>**1/13/1981** | **7094090**<br>**5/1/1981** | **7094090**<br>**6/3/1981** | **7094090**<br>**6/17/1981** |
|---|---|---|---|---|---|---|
| Alkalinity, total | Total | mg/l CaCO3 | | | | |
| Alpha emitting radium isotopes | Dissolved | pCi/L | <0.1 | <0.1 | | 0.1 |
| Alpha particle | Dissolved | pCi/L | 44 | 30 | 13 | 21 |
| Alpha particle | Dissolved | ug/l | 64 | 44 | 19 | 31 |
| Alpha particle | Suspended | pCi/L | 5 | 0.7 | 75 | 0.7 |
| Alpha particle | Suspended | ug/l | 7.3 | 1.1 | 110 | 1 |
| Ammonia-nitrogen | Total | | | | | |
| Arsenic | Dissolved | ug/l | 2 | 1 | 2 | 2 |
| Barium | Dissolved | ug/l | 100 | 200 | 10 | 100 |
| Beta particle | Dissolved | pCi/L | 9.1 | 9.7 | 11 | 11 |
| Beta particle | Dissolved | pCi/L | 8.7 | 9.2 | 10 | 11 |
| Beta particle | Suspended | pCi/L | 6.2 | 1.8 | 71 | 0.8 |
| Beta particle | Suspended | pCi/L | 6 | 1.7 | 69 | 0.8 |
| Bicarbonate | Total | mg/l | | | | |
| Cadmium | Dissolved | ug/l | 0 | 0 | <10 | <10 |
| Calcium | Dissolved | mg/l | | | | |
| Carbon dioxide | Total | mg/l | | | | |
| Carbonate | Total | mg/l | | | | |
| Chloride | Dissolved | mg/l | | | | |
| Chloride | Dissolved | mg/l | 22 | 25 | 24 | 27 |
| Chromium | Recoverable | ug/l | 25 | 1 | 15 | 5 |
| Copper | Dissolved | | | | | |
| Fluoride | Dissolved | mg/l | | | | |
| Gross-Uranium | Dissolved | ug/l | 22.6 | 22.5 | 12.5 | 22.3 |
| Hardness, Ca, Mg | | mg/l CaCO3 | | | | |
| Hardness, non-carbonate | Total | mg/l CaCO3 | | | | |
| Hydrogen ion | Total | mg/l | <0.001 | <0.001 | <0.001 | <0.001 |
| Nitrate + Nitrite | Dissolved | mg/l N | | | | |
| Nitrate + Nitrite | Total | | | | | |
| Iron | Dissolved | ug/l | | | | |
| Iron | Total Recoverable | | | | | |
| Lead | Dissolved | ug/l | <100 | 0 | <100 | <100 |

## Currant Creek

| Station Number | | | 7094090 | 7094090 | 7094090 | 7094090 |
|---|---|---|---|---|---|---|
| **Date** | | | **1/13/1981** | **5/1/1981** | **6/3/1981** | **6/17/1981** |
| Magnesium | Dissolved | mg/l | | | | |
| Manganese | Dissolved | ug/l | | | | |
| Orthophosphate | Dissolved | mg/l as P | | | | |
| Orthophosphate | Dissolved | mg/l asPO4 | | | | |
| Oxygen | Dissolved | mg/l | 11.9 | 7.6 | 8.4 | 6.8 |
| pH | Total | std units | 8.5 | 8.8 | 8.6 | 8.4 |
| pH | Total | std units | 8.3 | 8.5 | 7.9 | 8.4 |
| Phosphate-phosphorus | Total | | | | | |
| Potassium | Dissolved | mg/l | | | | |
| Selenium | Dissolved | ug/l | 1 | 2 | 0 | 0 |
| Silica | Dissolved | mg/l | | | | |
| Silver | Dissolved | ug/l | 0 | 0 | 1 | 0 |
| Sodium | Dissolved | mg/l | | | | |
| Sodium adsorption ratio | | None | | | | |
| Sodium, percent total cations | | % | | | | |
| Specific conductance | Total | uS/cm @25C | 722 | 619 | 520 | 683 |
| Specific conductance | Total | uS/cm @25C | 700 | 649 | | 710 |
| Stream flow, instantaneous | | ft3/s | 5.7 | 1 | 7.2 | 1 |
| Stream flow, instantaneous | | m3/sec | 0.16 | 0.03 | 0.2 | 0.03 |
| Sulfate | Dissolved | mg/l | 66 | 65 | 50 | 3.2 |
| Temperature, water | | deg C | 1 | 25 | 11 | 25.5 |
| Total dissolved solids | Dissolved | mg/l | | | | |
| Zinc | Dissolved | | | | | |

| **Station Number** | | **7094090** | **7094090** | **7094090** | **7094090** |
|---|---|---|---|---|---|
| **Date** | | **1/13/1981** | **5/1/1981** | **6/3/1981** | **6/17/1981** |
| Alkalinity, total | Total | 330 | | | |
| Ammonia-nitrogen | Total | <0.03 | | | |
| Cadmium | Dissolved | <0.6 | | | |
| Copper | Dissolved | 6 | | | |
| Dissolved oxygen (DO) | | 7.8 | | | |
| Hardness, Ca, Mg | Total | 250 | | | |
| Inorganic nitrogen (nitrate and nitri | Total | <0.03 | | | |
| Iron | Dissolved | <10 | | | |
| Iron | Total Recoverable | <50 | | | |
| Lead | Dissolved | <1 | | | |
| Manganese | Dissolved | 3 | | | |
| pH | | 8.49 | | | |
| Phosphate-phosphorus | Total | 0.24 | | | |
| Selenium | Dissolved | <1 | | | |
| Silver | Dissolved | <1 | | | |
| Specific conductance | | 843.5 | | | |
| Sulfate | Total | 58 | | | |
| Temperature, water | | 22.68 | | | |
| Zinc | Dissolved | <10 | | | |

## Currant Creek

| Station Number | | | 7094090 | 7094090 | 7094090 | 7094090 |
|---|---|---|---|---|---|---|
| Date | | | 7/17/1981 | 8/4/1981 | 8/10/1981 | 9/8/1981 |
| Alkalinity, total | Total | mg/l CaCO3 | | | 130 | |
| Alpha emitting radium isotopes | Dissolved | pCi/L | <0.1 | 0.1 | <0.1 | <0.1 |
| Alpha particle | Dissolved | pCi/L | 33 | 23 | 3.1 | 27 |
| Alpha particle | Dissolved | ug/l | 48 | 34 | 4.5 | 39 |
| Alpha particle | Suspended | pCi/L | <0.3 | <0.3 | 410 | 5.4 |
| Alpha particle | Suspended | ug/l | <0.4 | <0.4 | 610 | 7.9 |
| Ammonia-nitrogen | Total | | | | | |
| Arsenic | Dissolved | ug/l | 1 | 1 | | 1 |
| Barium | Dissolved | ug/l | 100 | 100 | 200 | 100 |
| Beta particle | Dissolved | pCi/L | 12 | 13 | 12 | 9.8 |
| Beta particle | Dissolved | pCi/L | 11 | 13 | 12 | 9.2 |
| Beta particle | Suspended | pCi/L | 0.6 | <0.4 | 380 | 6.9 |
| Beta particle | Suspended | pCi/L | 0.6 | <0.4 | 360 | 6.7 |
| Bicarbonate | Total | mg/l | | | | |
| Cadmium | Dissolved | ug/l | 0 | 0 | 0 | <10 |
| Calcium | Dissolved | mg/l | | | | |
| Carbon dioxide | Total | mg/l | | | 3.2 | |
| Carbonate | Total | mg/l | | | | |
| Chloride | Dissolved | mg/l | | | | |
| Chloride | Dissolved | mg/l | 33 | 31 | 12 | 22 |
| Chromium | Recoverable | ug/l | 3 | 9 | 210 | 10 |
| Copper | Dissolved | | | | | |
| Fluoride | Dissolved | mg/l | | | | |
| Gross-Uranium | Dissolved | ug/l | 24.3 | 22 | 11.2 | 17 |
| Hardness, Ca, Mg | | mg/l CaCO3 | | | | |
| Hardness, non-carbonate | Total | mg/l CaCO3 | | | | |
| Hydrogen ion | Total | mg/l | 0.00001 | 0.00001 | 0.00001 | <0.001 |
| Nitrate + Nitrite | Dissolved | mg/l N | | | | |
| Nitrate + Nitrite | Total | | | | | |
| Iron | Dissolved | ug/l | | | | |
| Iron | Total Recoverable | | | | | |
| Lead | Dissolved | ug/l | 0 | <100 | 0 | <100 |

| **Station Number**<br>**Date** | | | **7094090**<br>**7/17/1981** | **7094090**<br>**8/4/1981** | **7094090**<br>**8/10/1981** | **7094090**<br>**9/8/1981** |
|---|---|---|---|---|---|---|
| Magnesium | Dissolved | mg/l | | | | |
| Manganese | Dissolved | ug/l | | | | |
| Orthophosphate | Dissolved | mg/l as P | | | | |
| Orthophosphate | Dissolved | mg/l asPO4 | | | | |
| Oxygen | Dissolved | mg/l | 7.4 | 6.7 | 8.5 | 6.5 |
| pH | Total | std units | 8.1 | 8.1 | 7.9 | 8.4 |
| pH | Total | std units | 8.2 | 8.4 | 7.6 | 8.6 |
| Phosphate-phosphorus | Total | | | | | |
| Potassium | Dissolved | mg/l | | | | |
| Selenium | Dissolved | ug/l | 0 | 0 | 1 | 1 |
| Silica | Dissolved | mg/l | | | | |
| Silver | Dissolved | ug/l | 0 | 0 | 0 | 0 |
| Sodium | Dissolved | mg/l | | | | |
| Sodium adsorption ratio | | None | | | | |
| Sodium, percent total cations | | % | | | | |
| Specific conductance | Total | uS/cm @25C | 656 | 690 | 342 | 680 |
| Specific conductance | Total | uS/cm @25C | 674 | 700 | | |
| Stream flow, instantaneous | | ft3/s | 0.3 | 0.68 | 31 | 4.6 |
| Stream flow, instantaneous | | m3/sec | 0.01 | 0.02 | 0.88 | 0.13 |
| Sulfate | Dissolved | mg/l | 70 | 60 | 3 | 59 |
| Temperature, water | | deg C | 24.5 | 22.5 | 13 | 20.5 |
| Total dissolved solids | Dissolved | mg/l | | | | |
| Zinc | Dissolved | | | | | |

## Currant Creek

| **Station Number** | | **7094090** | **7094090** | **7094090** | **7094090** |
|---|---|---|---|---|---|
| **Date** | | **7/17/1981** | **8/4/1981** | **8/10/1981** | **9/8/1981** |
| Alkalinity, total | Total | | | | |
| Ammonia-nitrogen | Total | | | | |
| Cadmium | Dissolved | | | | |
| Copper | Dissolved | | | | |
| Dissolved oxygen (DO) | | | | | |
| Hardness, Ca, Mg | Total | | | | |
| Inorganic nitrogen (nitrate and nitri | Total | | | | |
| Iron | Dissolved | | | | |
| Iron | Total Recoverable | | | | |
| Lead | Dissolved | | | | |
| Manganese | Dissolved | | | | |
| pH | | | | | |
| Phosphate-phosphorus | Total | | | | |
| Selenium | Dissolved | | | | |
| Silver | Dissolved | | | | |
| Specific conductance | | | | | |
| Sulfate | Total | | | | |
| Temperature, water | | | | | |
| Zinc | Dissolved | | | | |

Currant Creek

| **Station Number**<br>**Date** | | | **7094090**<br>**4/7/1982** | **7094090**<br>**5/20/1982** | **7094090**<br>**6/22/1982** | **7094090**<br>**9/21/1982** |
|---|---|---|---|---|---|---|
| Alkalinity, total | Total | mg/l CaCO3 | | | | |
| Alpha emitting radium isotopes | Dissolved | pCi/L | <0.1 | <0.1 | <0.1 | <0.1 |
| Alpha particle | Dissolved | pCi/L | 23 | 19 | 29 | 18 |
| Alpha particle | Dissolved | ug/l | 34 | 28 | 43 | 26 |
| Alpha particle | Suspended | pCi/L | <0.3 | 0.5 | 1.2 | 6 |
| Alpha particle | Suspended | ug/l | <0.4 | 0.7 | 1.8 | 8.8 |
| Ammonia-nitrogen | Total | | | | | |
| Arsenic | Dissolved | ug/l | 1 | 1 | 1 | 1 |
| Barium | Dissolved | ug/l | 100 | 100 | <100 | 100 |
| Beta particle | Dissolved | pCi/L | 14 | 7.2 | 7.3 | 11 |
| Beta particle | Dissolved | pCi/L | 14 | 6.9 | 7 | 11 |
| Beta particle | Suspended | pCi/L | 0.9 | 2.3 | 3.4 | 6.7 |
| Beta particle | Suspended | pCi/L | 0.8 | 2.3 | 3.2 | 6.4 |
| Bicarbonate | Total | mg/l | | | | |
| Cadmium | Dissolved | ug/l | <1 | <1 | <10 | <1 |
| Calcium | Dissolved | mg/l | | | | |
| Carbon dioxide | Total | mg/l | | | | |
| Carbonate | Total | mg/l | | | | |
| Chloride | Dissolved | mg/l | | | | |
| Chloride | Dissolved | mg/l | 24 | 26 | 25 | 23 |
| Chromium | Recoverable | ug/l | 7 | 4 | 5 | 4 |
| Copper | Dissolved | | | | | |
| Fluoride | Dissolved | mg/l | | | | |
| Gross-Uranium | Dissolved | ug/l | 27 | 22 | 24 | 22 |
| Hardness, Ca, Mg | | mg/l CaCO3 | | | | |
| Hardness, non-carbonate | Total | mg/l CaCO3 | | | | |
| Hydrogen ion | Total | mg/l | <0.001 | 0.00001 | 0.00001 | 0.00001 |
| Nitrate + Nitrite | Dissolved | mg/l N | | | | |
| Nitrate + Nitrite | Total | | | | | |
| Iron | Dissolved | ug/l | | | | |
| Iron | Total Recoverable | | | | | |
| Lead | Dissolved | ug/l | <1 | <1 | <100 | <1 |

# Currant Creek

| **Station Number** | | | **7094090** | **7094090** | **7094090** | **7094090** |
|---|---|---|---|---|---|---|
| **Date** | | | **4/7/1982** | **5/20/1982** | **6/22/1982** | **9/21/1982** |
| Magnesium | Dissolved | mg/l | | | | |
| Manganese | Dissolved | ug/l | | | | |
| Orthophosphate | Dissolved | mg/l as P | | | | |
| Orthophosphate | Dissolved | mg/l asPO4 | | | | |
| Oxygen | Dissolved | mg/l | 8.5 | 8 | 6.7 | 6.7 |
| pH | Total | std units | 9 | 8.3 | 8.1 | 8.3 |
| pH | Total | std units | 8.6 | 8.6 | 8.6 | 8.5 |
| Phosphate-phosphorus | Total | | | | | |
| Potassium | Dissolved | mg/l | | | | |
| Selenium | Dissolved | ug/l | 1 | 1 | 1 | 1 |
| Silica | Dissolved | mg/l | | | | |
| Silver | Dissolved | ug/l | <1 | <1 | <1 | <1 |
| Sodium | Dissolved | mg/l | | | | |
| Sodium adsorption ratio | | None | | | | |
| Sodium, percent total cations | | % | | | | |
| Specific conductance | Total | uS/cm @25C | 645 | 706 | 686 | 643 |
| Specific conductance | Total | uS/cm @25C | 702 | 708 | 677 | 644 |
| Stream flow, instantaneous | | ft3/s | 3 | 0.72 | 1.8 | 8 |
| Stream flow, instantaneous | | m3/sec | 0.08 | 0.02 | 0.05 | 0.23 |
| Sulfate | Dissolved | mg/l | 58 | 57 | 61 | 51 |
| Temperature, water | | deg C | 14 | 20 | 20.5 | 19 |
| Total dissolved solids | Dissolved | mg/l | | | | |
| Zinc | Dissolved | | | | | |

| **Station Number** | | **7094090** | **7094090** | **7094090** | **7094090** |
|---|---|---|---|---|---|
| **Date** | | **4/7/1982** | **5/20/1982** | **6/22/1982** | **9/21/1982** |
| Alkalinity, total | Total | | | | |
| Ammonia-nitrogen | Total | | | | |
| Cadmium | Dissolved | | | | |
| Copper | Dissolved | | | | |
| Dissolved oxygen (DO) | | | | | |
| Hardness, Ca, Mg | Total | | | | |
| Inorganic nitrogen (nitrate and nitri | Total | | | | |
| Iron | Dissolved | | | | |
| Iron | Total Recoverable | | | | |
| Lead | Dissolved | | | | |
| Manganese | Dissolved | | | | |
| pH | | | | | |
| Phosphate-phosphorus | Total | | | | |
| Selenium | Dissolved | | | | |
| Silver | Dissolved | | | | |
| Specific conductance | | | | | |
| Sulfate | Total | | | | |
| Temperature, water | | | | | |
| Zinc | Dissolved | | | | |

Currant Creek

| **Station Number**<br>**Date** | | | **383150105225500**<br>**4/22/1972** | **21COL001-7110**<br>**8/17/2010** |
|---|---|---|---|---|
| Alkalinity, total | Total | mg/l CaCO3 | 224 | 330 |
| Alpha emitting radium isotopes | Dissolved | pCi/L | | |
| Alpha particle | Dissolved | pCi/L | | |
| Alpha particle | Dissolved | ug/l | | |
| Alpha particle | Suspended | pCi/L | | |
| Alpha particle | Suspended | ug/l | | |
| Ammonia-nitrogen | Total | | | <0.03 |
| Arsenic | Dissolved | ug/l | | |
| Barium | Dissolved | ug/l | | |
| Beta particle | Dissolved | pCi/L | | |
| Beta particle | Dissolved | pCi/L | | |
| Beta particle | Suspended | pCi/L | | |
| Beta particle | Suspended | pCi/L | | |
| Bicarbonate | Total | mg/l | 273 | |
| Cadmium | Dissolved | ug/l | | <0.6 |
| Calcium | Dissolved | mg/l | 73 | |
| Carbon dioxide | Total | mg/l | 44 | |
| Carbonate | Total | mg/l | 0 | |
| Chloride | Dissolved | mg/l | 13 | |
| Chloride | Dissolved | mg/l | | |
| Chromium | Recoverable | ug/l | | |
| Copper | Dissolved | | | 6 |
| Fluoride | Dissolved | mg/l | 1.2 | |
| Gross-Uranium | Dissolved | ug/l | | |
| Hardness, Ca, Mg | | mg/l CaCO3 | 260 | 250 |
| Hardness, non-carbonate | Total | mg/l CaCO3 | 37 | |
| Hydrogen ion | Total | mg/l | 0.0001 | |
| Nitrate + Nitrite | Dissolved | mg/l N | 0.01 | |
| Nitrate + Nitrite | Total | | | <0.03 |
| Iron | Dissolved | ug/l | 8100 | <10 |
| Iron | Total Recoverable | | | <50 |
| Lead | Dissolved | ug/l | | <1 |

Currant Creek

| **Station Number**<br>**Date** | | | **383150105225500**<br>**4/22/1972** | **21COL001-7110**<br>**8/17/2010** |
|---|---|---|---|---|
| Magnesium | Dissolved | mg/l | 19 | |
| Manganese | Dissolved | ug/l | 240 | 3 |
| Orthophosphate | Dissolved | mg/l as P | 0 | |
| Orthophosphate | Dissolved | mg/l asPO4 | 0 | |
| Oxygen | Dissolved | mg/l | | 7.8 |
| pH | Total | std units | 7 | 8.49 |
| pH | Total | std units | | |
| Phosphate-phosphorus | Total | | | 0.24 |
| Potassium | Dissolved | mg/l | 6.5 | |
| Selenium | Dissolved | ug/l | | <1 |
| Silica | Dissolved | mg/l | 14 | |
| Silver | Dissolved | ug/l | | <1 |
| Sodium | Dissolved | mg/l | 33 | |
| Sodium adsorption ratio | | None | 0.9 | |
| Sodium, percent total cations | | % | 21 | |
| Specific conductance | Total | uS/cm @25C | 626 | 843.5 |
| Specific conductance | Total | uS/cm @25C | | |
| Stream flow, instantaneous | | ft3/s | | |
| Stream flow, instantaneous | | m3/sec | | |
| Sulfate | Dissolved | mg/l | 100 | 58 |
| Temperature, water | | deg C | 15 | 22.68 |
| Total dissolved solids | Dissolved | mg/l | 402 | |
| Zinc | Dissolved | | | <10 |

| **Station Number** | | **383150105225500** | **21COL001-7110** |
|---|---|---|---|
| **Date** | | **4/22/1972** | **8/17/2010** |
| Alkalinity, total | Total | | |
| Ammonia-nitrogen | Total | | |
| Cadmium | Dissolved | | |
| Copper | Dissolved | | |
| Dissolved oxygen (DO) | | | |
| Hardness, Ca, Mg | Total | | |
| Inorganic nitrogen (nitrate and nitri | Total | | |
| Iron | Dissolved | | |
| Iron | Total Recoverable | | |
| Lead | Dissolved | | |
| Manganese | Dissolved | | |
| pH | | | |
| Phosphate-phosphorus | Total | | |
| Selenium | Dissolved | | |
| Silver | Dissolved | | |
| Specific conductance | | | |
| Sulfate | Total | | |
| Temperature, water | | | |
| Zinc | Dissolved | | |

# Tallahassee Creek

| **Station Number** | | | **21COL001-7115** | **21COL001-7115** | **21COL001-7115** | **21COL001-7115** | **21COL001-7115** |
|---|---|---|---|---|---|---|---|
| **Date** | | | **9/12/2005** | **10/20/2005** | **8/17/2010** | **10/26/2010** | **6/21/2011** |
| Alkalinity, total | Total | mg/l | 290 | 280 | 280 | 310 | 300 |
| Ammonia-nitrogen | Total | mg/l | <0.03 | <0.03 | <0.03 | <0.03 | |
| Arsenic | Dissolved | ug/l | 1 | 1 | | | |
| Cadmium | Dissolved | ug/l | 0.6 | <0.6 | <0.6 | <0.6 | |
| Calcium | Total | mg/l | | | | | 72 |
| Copper | Dissolved | ug/l | <5 | <5 | 7 | <5 | <5 |
| Hardness, Ca, Mg | Total | mg/l | 310 | 300 | 230 | 310 | 300 |
| Nitrate + Nitrite | Total | mg/l N | <0.3 | <0.3 | 0.76 | 0.6 | |
| Iron | Dissolved | ug/l | <10 | <10 | <10 | <10 | <4 |
| Iron | Total Recovrble | ug/l | <10 | <10 | <50 | <10 | 10 |
| Kjeldahl nitrogen | Total | mg/l | <0.5 | <0.5 | | <0.1 | 0.2 |
| Lead | Dissolved | ug/l | <1 | <1 | <1 | <1 | <0.01 |
| Magnesium | Total | mg/l | | | | | 33 |
| Manganese | Dissolved | ug/l | <2 | <2 | 3 | <2 | <2 |
| Oxygen | Dissolved | mg/l | 6.44 | 9.42 | 8.1 | 12.55 | 7.12 |
| pH | Total | | 8.58 | 8.61 | 8.58 | 8.75 | 8.47 |
| Phosphate-phosphorus as P | Total | mg/l | 0.044 | 0.025 | 0.3 | 0.089 | 0.11 |
| Selenium | Dissolved | ug/l | 6.8 | 12 | 2.8 | 3.2 | 3.1 |
| Silver | Dissolved | ug/l | <0.5 | <0.5 | <1 | <1 | |
| Sodium | Total | mg/l | | | | | 65 |
| Specific conductance | | umho/cm | 901 | 884 | 750.1 | 841.6 | 932.4 |
| Sulfate | Total | mg/l | 120 | 110 | 64 | 77 | 96 |
| Temperature, water | | deg C | 21.62 | 15.18 | 21.36 | 9.18 | 17.06 |
| Uranium | Dissolved | ug/l | 26 | 23 | | | |
| Zinc | Dissolved | ug/l | <10 | <10 | <10 | <10 | 8 |

# Tallahassee Creek

| **Station Number** | | | **21COL001-TALlAHASSEE04** |
|---|---|---|---|
| **Date** | | | **8/14/1980** |
| Alkalinity, total | | mg/l | 246 |
| Aluminum | Total Recovrble | ug/l | 1 |
| Ammonia | | mg/l | 0.00957 |
| Ammonia-nitrogen | Total | mg/l | 0.05 |
| Ammonia-nitrogen as N | | mg/l | 0.00787 |
| Arsenic | Total | ug/l | 0.01 |
| Boron | Total | ug/l | 40 |
| Cadmium | Total Recovrble | ug/l | 0.0003 |
| Copper | Total Recovrble | ug/l | 0.005 |
| Dissolved oxygen (DO) | | mg/l | 7 |
| Dissolved oxygen saturation | | % | 79.55 |
| Hardness, Ca, Mg | Total | mg/l | 210 |
| Nitrate + Nitrite | Total | mg/l N | 0.5 |
| Iron | Total | ug/l | 0.1 |
| Lead | Total Recovrble | ug/l | 0.006 |
| Manganese | Total Recovrble | ug/l | 0.05 |
| Mercury | Total Recovrble | ug/l | 0.0005 |
| Molybdenum | Total Recovrble | ug/l | 0.01 |
| Nickel | Total Recovrble | ug/l | 0.05 |
| pH | | None | 8.6 |
| Sodium | Total | mg/l | 24 |
| Specific conductance | | uS/cm | 424 |
| Sulfate as SO4 | Total | mg/l | 37 |
| Temperature, water | | deg C | 22.3 |
| Total dissolved solids | Dissolved | mg/l | 300 |
| Total suspended solids | Total | mg/l | 10 |
| Zinc | Total | ug/l | 0.02 |

Tallahassee Creek

| Station Number<br>Date | | | 07094300<br>1/13/1981 | 07094300<br>5/1/1981 | 07094300<br>6/3/1981 | 07094300<br>6/17/1981 | 07094300<br>8/10/1981 | 07094300<br>4/8/1981 |
|---|---|---|---|---|---|---|---|---|
| Alkalinity, total | Total | mg/l CaCO3 | | | | | 83 | |
| Alpha emitting radium isotopes | Dissolved | pCi/L | <0.1 | 0.1 | | <0.1 | 0.7 | 0.1 |
| Alpha particle | Dissolved | pCi/L | 23 | 17 | 13 | 23 | <4.7 | 12 |
| Alpha particle | Dissolved | ug/l | 34 | 25 | 19 | 34 | <6.8 | 17 |
| Alpha particle | Suspended | pCi/L | <0.3 | <0.3 | 3.2 | 1.4 | 1000 | <0.3 |
| Alpha particle | Suspended | ug/l | <0.4 | <0.4 | 4.7 | 2.1 | 1500 | <0.4 |
| Aluminum | Dissolved | ug/l | | | | | | |
| Ammonia and ammonium | Total | mg/l as N | | | | | | |
| Ammonia and ammonium | Total | mg/l NH4 | | | | | | |
| Arsenic | Dissolved | ug/l | 3 | 2 | 3 | 1 | | 2 |
| Barium | Dissolved | ug/l | 100 | 200 | 100 | 100 | 400 | 100 |
| Barium | Dissolved | ug/l | | | | | | |
| Beryllium | Dissolved | ug/l | | | | | | |
| Beta particle | Dissolved | pCi/L | 7.7 | 8.1 | 8.5 | 8.5 | 9.4 | 15 |
| Beta particle | Dissolved | pCi/L | 7.3 | 7.6 | 8.2 | 8.3 | 9 | 14 |
| Beta particle | Suspended | pCi/L | 1.3 | 0.7 | 5.9 | 1.2 | 640 | 0.7 |
| Beta particle | Suspended | pCi/L | 1.3 | 0.8 | 5.7 | 1.2 | 620 | 0.7 |
| Cadmium | Dissolved | ug/l | 0 | 0 | 0 | <10 | 0 | <10 |
| Cadmium | Total | ug/l | | | | | | |
| Calcium | Dissolved | mg/l | | | | | | |
| Carbon dioxide | Total | mg/l | | | | | | |
| Chloride | Dissolved | mg/l | 11 | 16 | 10 | 28 | 15 | 16 |
| Chromium | Recoverable | ug/l | 7 | 1 | 4 | 4 | 160 | 2 |
| Cobalt | Dissolved | ug/l | | | | | | |
| Copper | Dissolved | ug/l | | | | | | |
| Copper | Recoverable | ug/l | | | | | | |
| Gross-Uranium | Dissolved | ug/l | 19.7 | 17.1 | 23.9 | 22.8 | 2.6 | 23 |
| Hardness, Ca, Mg | | mg/l CaCO3 | | | | | | |
| Hydrogen ion | Total | mg/l | 0.00001 | <0.001 | 0.00001 | 0.00001 | | <0.001 |
| Nitrate + Nitrite | Total | mg/l as N | | | | | | |
| Iron | Dissolved | ug/l | | | | | | |
| Iron | Recoverable | ug/l | | | | | | |

Tallahassee Creek

| **Station Number**<br>**Date** | | | **07094300**<br>**1/13/1981** | **07094300**<br>**5/1/1981** | **07094300**<br>**6/3/1981** | **07094300**<br>**6/17/1981** | **07094300**<br>**8/10/1981** | **07094300**<br>**4/8/1981** |
|---|---|---|---|---|---|---|---|---|
| Lead | Dissolved | ug/l | <100 | 0 | 0 | <100 | 0 | <100 |
| Lead | Recoverable | ug/l | | | | | | |
| Lithium | Dissolved | ug/l | | | | | | |
| Magnesium | Dissolved | mg/l | | | | | | |
| Manganese | Dissolved | ug/l | | | | | | |
| Manganese | Recoverable | ug/l | | | | | | |
| Molybdenum | Dissolved | ug/l | | | | | | |
| Nitrate | Total | mg/l as N | | | | | | |
| Organic carbon | Total | mg/l | | | | | | |
| Orthophosphate | Total | mg/l as P | | | | | | |
| Oxygen | Dissolved | mg/l | 11.8 | 7.7 | 7.8 | 7.6 | | 8.8 |
| pH | Total | std units | 8.2 | 8.4 | 8.2 | 8.3 | 7.1 | 8.5 |
| pH | Total | std units | 8.2 | 8.7 | 8.4 | 8.3 | | 8.6 |
| Phosphate-phosphorus | Total | mg/l | | | | | | |
| Potassium | Dissolved | mg/l | | | | | | |
| Selenium | Dissolved | ug/l | 2 | 2 | 1 | 0 | | 2 |
| Silica | Dissolved | mg/l | | | | | | |
| Silver | Dissolved | ug/l | 0 | 0 | 1 | 0 | 0 | <1 |
| Sodium | Dissolved | mg/l | | | | | | |
| Sodium adsorption ratio | | None | | | | | | |
| Sodium, percent total cations | | % | | | | | | |
| Specific conductance | Total | uS/cm @25C | 476 | 504 | 472 | 683 | 247 | 470 |
| Specific conductance | Total | uS/cm @25C | | 498 | 476 | 593 | | 483 |
| Stream flow, instantaneous | | ft3/s | 0.77 | 0.5 | 5.1 | 0.3 | 44 | 0.65 |
| Stream flow, instantaneous | | m3/sec | 0.02 | 0.01 | 0.14 | 0.01 | 1.2 | 0.02 |
| Strontium | Dissolved | ug/l | | | | | | |
| Sulfate | Dissolved | mg/l | 44 | 46 | 45 | 50 | 2 | 41 |
| Temperature, water | | deg C | 0.5 | 17 | 16.5 | 16.5 | | 9.5 |
| Total dissolved solids | Dissolved | mg/l | | | | | | |
| Vanadium | Dissolved | ug/l | | | | | | |
| Zinc | Dissolved | ug/l | | | | | | |
| Zinc | Recoverable | ug/l | | | | | | |

Tallahassee Creek

| **Station Number**<br>**Date** | | | **07094300**<br>**9/8/1981** | **07094300**<br>**5/20/1982** | **07094300**<br>**6/22/1982** | **07094300**<br>**7/23/1982** | **07094300**<br>**9/21/1982** | **07094300**<br>**4/24/1987** |
|---|---|---|---|---|---|---|---|---|
| Alkalinity, total | Total | mg/l CaCO3 | | | | | | |
| Alpha emitting radium isotopes | Dissolved | pCi/L | 0.2 | <0.1 | 0.1 | 0.2 | <0.1 | |
| Alpha particle | Dissolved | pCi/L | 19 | 9.5 | 15 | 10 | 12 | |
| Alpha particle | Dissolved | ug/l | 28 | 14 | 22 | 15 | 18 | |
| Alpha particle | Suspended | pCi/L | 1.2 | <0.3 | 2.1 | <0.3 | 0.3 | |
| Alpha particle | Suspended | ug/l | 1.8 | <0.4 | 3.1 | <0.4 | 0.5 | |
| Aluminum | Dissolved | ug/l | | | | | | |
| Ammonia and ammonium | Total | mg/l as N | | | | | | |
| Ammonia and ammonium | Total | mg/l NH4 | | | | | | |
| Arsenic | Dissolved | ug/l | 2 | 2 | 2 | 2 | 2 | |
| Barium | Dissolved | ug/l | 400 | 100 | <100 | 100 | <100 | |
| Barium | Dissolved | ug/l | | | | | | |
| Beryllium | Dissolved | ug/l | | | | | | |
| Beta particle | Dissolved | pCi/L | 10 | 7.2 | 8.9 | 9.9 | 11 | |
| Beta particle | Dissolved | pCi/L | 9.9 | 6.9 | 8.6 | 9.5 | 11 | |
| Beta particle | Suspended | pCi/L | 4 | 2.7 | 3.3 | 2.1 | 1.9 | |
| Beta particle | Suspended | pCi/L | 3.8 | 2.7 | 3.2 | 2.1 | 1.9 | |
| Cadmium | Dissolved | ug/l | <10 | <1 | 30 | <10 | <1 | |
| Cadmium | Total | ug/l | | | | | | |
| Calcium | Dissolved | mg/l | | | | | | |
| Carbon dioxide | Total | mg/l | | | | | | |
| Chloride | Dissolved | mg/l | 15 | 18 | 11 | 18 | 6.4 | |
| Chromium | Recoverable | ug/l | 10 | 6 | 4 | 7 | 2 | |
| Cobalt | Dissolved | ug/l | | | | | | |
| Copper | Dissolved | ug/l | | | | | | |
| Copper | Recoverable | ug/l | | | | | | |
| Gross-Uranium | Dissolved | ug/l | 20 | 20 | 20 | 17 | 13 | |
| Hardness, Ca, Mg | | mg/l CaCO3 | | | | | | |
| Hydrogen ion | Total | mg/l | 0.00001 | 0.00002 | 0.00001 | 0.00001 | 0.00001 | <0.001 |
| Nitrate + Nitrite | Total | mg/l as N | | | | | | |
| Iron | Dissolved | ug/l | | | | | | |
| Iron | Recoverable | ug/l | | | | | | |

| **Station Number**<br>**Date** | | | **07094300**<br>**9/8/1981** | **07094300**<br>**5/20/1982** | **07094300**<br>**6/22/1982** | **07094300**<br>**7/23/1982** | **07094300**<br>**9/21/1982** | **07094300**<br>**4/24/1987** |
|---|---|---|---|---|---|---|---|---|
| Lead | Dissolved | ug/l | <100 | <1 | <100 | <1 | <1 | |
| Lead | Recoverable | ug/l | | | | | | |
| Lithium | Dissolved | ug/l | | | | | | |
| Magnesium | Dissolved | mg/l | | | | | | |
| Manganese | Dissolved | ug/l | | | | | | |
| Manganese | Recoverable | ug/l | | | | | | |
| Molybdenum | Dissolved | ug/l | | | | | | |
| Nitrate | Total | mg/l as N | | | | | | |
| Organic carbon | Total | mg/l | | | | | | |
| Orthophosphate | Total | mg/l as P | | | | | | |
| Oxygen | Dissolved | mg/l | 7.1 | 9.3 | 7.3 | 7.3 | 7.4 | 9.7 |
| pH | Total | std units | 8.3 | 7.8 | 8.1 | 8.2 | 8.1 | 8.9 |
| pH | Total | std units | 8.7 | 8.4 | 8.9 | 8.8 | 8.7 | |
| Phosphate-phosphorus | Total | mg/l | | | | | | |
| Potassium | Dissolved | mg/l | | | | | | |
| Selenium | Dissolved | ug/l | 1 | 1 | 1 | 1 | 1 | |
| Silica | Dissolved | mg/l | | | | | | |
| Silver | Dissolved | ug/l | 0 | <1 | <1 | <1 | <1 | |
| Sodium | Dissolved | mg/l | | | | | | |
| Sodium adsorption ratio | | None | | | | | | |
| Sodium, percent total cations | | % | | | | | | |
| Specific conductance | Total | uS/cm @25C | 475 | 517 | 509 | 561 | 405 | 394 |
| Specific conductance | Total | uS/cm @25C | | 498 | 497 | 557 | 387 | |
| Stream flow, instantaneous | | ft3/s | 0.73 | 0.51 | 1.2 | 0.8 | 4 | 172 |
| Stream flow, instantaneous | | m3/sec | 0.02 | 0.01 | 0.03 | 0.02 | 0.11 | 4.9 |
| Strontium | Dissolved | ug/l | | | | | | |
| Sulfate | Dissolved | mg/l | 14 | 39 | 47 | 35 | 25 | |
| Temperature, water | | deg C | 16.5 | 12.5 | 20 | 22 | 13.5 | 6.5 |
| Total dissolved solids | Dissolved | mg/l | | | | | | |
| Vanadium | Dissolved | ug/l | | | | | | |
| Zinc | Dissolved | ug/l | | | | | | |
| Zinc | Recoverable | ug/l | | | | | | |

# Tallahassee Creek

| **Station Number** | | | **07094300** | **07094300** | **07094300** | **07094300** | **07094300** | **07094300** |
|---|---|---|---|---|---|---|---|---|
| **Date** | | | **6/3/1987** | **10/29/1987** | **4/20/1990** | **6/7/1990** | **7/19/1990** | **8/30/1990** |
| Alkalinity, total | Total | mg/l CaCO3 | 470 | | | | | |
| Alpha emitting radium isotopes | Dissolved | pCi/L | | | | | | |
| Alpha particle | Dissolved | pCi/L | | | | | | |
| Alpha particle | Dissolved | ug/l | | | | | | |
| Alpha particle | Suspended | pCi/L | | | | | | |
| Alpha particle | Suspended | ug/l | | | | | | |
| Aluminum | Dissolved | ug/l | 50 | | | | | |
| Ammonia and ammonium | Total | mg/l as N | | | <0.01 | 0.03 | 0.03 | 0.02 |
| Ammonia and ammonium | Total | mg/l NH4 | | | <0.013 | 0.039 | 0.039 | 0.026 |
| Arsenic | Dissolved | ug/l | | | | | | |
| Barium | Dissolved | ug/l | | | | | | |
| Barium | Dissolved | ug/l | 78 | | | | | |
| Beryllium | Dissolved | ug/l | <0.5 | | | | | |
| Beta particle | Dissolved | pCi/L | | | | | | |
| Beta particle | Dissolved | pCi/L | | | | | | |
| Beta particle | Suspended | pCi/L | | | | | | |
| Beta particle | Suspended | pCi/L | | | | | | |
| Cadmium | Dissolved | ug/l | <1 | | <0.1 | <0.1 | 0.1 | <0.1 |
| Cadmium | Total | ug/l | | | <1 | <1 | <1 | <1 |
| Calcium | Dissolved | mg/l | 53 | | | | | |
| Carbon dioxide | Total | mg/l | 2.7 | | | | | |
| Chloride | Dissolved | mg/l | | | | | | |
| Chromium | Recoverable | ug/l | | | | | | |
| Cobalt | Dissolved | ug/l | <3 | | | | | |
| Copper | Dissolved | ug/l | <10 | | 1 | 1 | 1 | 1 |
| Copper | Recoverable | ug/l | | | 3 | 5 | 7 | 2 |
| Gross-Uranium | Dissolved | ug/l | | | | | | |
| Hardness, Ca, Mg | | mg/l CaCO3 | 228 | | | | | |
| Hydrogen ion | Total | mg/l | <0.001 | <0.001 | 0.00001 | <0.001 | <0.001 | <0.001 |
| Nitrate + Nitrite | Total | mg/l as N | | | 0.104 | 0.062 | 0.203 | 0.19 |
| Iron | Dissolved | ug/l | 24 | | 11 | 16 | 10 | 15 |
| Iron | Recoverable | ug/l | | | 370 | 650 | 6300 | 510 |

Tallahassee Creek

| **Station Number**<br>**Date** | | | **07094300**<br>**6/3/1987** | **07094300**<br>**10/29/1987** | **07094300**<br>**4/20/1990** | **07094300**<br>**6/7/1990** | **07094300**<br>**7/19/1990** | **07094300**<br>**8/30/1990** |
|---|---|---|---|---|---|---|---|---|
| Lead | Dissolved | ug/l | <10 | | <0.5 | <0.5 | <0.5 | <0.5 |
| Lead | Recoverable | ug/l | | | 1 | 2 | 5 | 1 |
| Lithium | Dissolved | ug/l | 29 | | | | | |
| Magnesium | Dissolved | mg/l | 23 | | | | | |
| Manganese | Dissolved | ug/l | 12 | | 130 | 69 | 120 | 100 |
| Manganese | Recoverable | ug/l | | | 190 | 100 | 360 | 140 |
| Molybdenum | Dissolved | ug/l | <10 | | | | | |
| Nitrate | Total | mg/l as N | | | | | | |
| Organic carbon | Total | mg/l | 5.5 | | | | | |
| Orthophosphate | Total | mg/l as P | | | | | | |
| Oxygen | Dissolved | mg/l | | 8 | 8.6 | 7.4 | 7.8 | 7.9 |
| pH | Total | std units | 8.5 | 8.9 | 8.3 | 8.5 | 8.5 | 8.4 |
| pH | Total | std units | | | 8.3 | 8.4 | 8.3 | 8.3 |
| Phosphate-phosphorus | Total | mg/l | | | | | | |
| Potassium | Dissolved | mg/l | 3.4 | | | | | |
| Selenium | Dissolved | ug/l | | | | | | |
| Silica | Dissolved | mg/l | 28 | | | | | |
| Silver | Dissolved | ug/l | | | | | | |
| Sodium | Dissolved | mg/l | 33 | | | | | |
| Sodium adsorption ratio | | None | 0.95 | | | | | |
| Sodium, percent total cations | | % | 24 | | | | | |
| Specific conductance | Total | uS/cm @25C | 521 | 600 | 736 | 645 | 702 | 699 |
| Specific conductance | Total | uS/cm @25C | | | 708 | 600 | 691 | 698 |
| Stream flow, instantaneous | | ft3/s | 42 | 8.2 | 0.54 | 2.6 | 4.7 | 2.8 |
| Stream flow, instantaneous | | m3/sec | 1.2 | 0.23 | 0.02 | 0.08 | 0.13 | 0.08 |
| Strontium | Dissolved | ug/l | 530 | | | | | |
| Sulfate | Dissolved | mg/l | | | | | | |
| Temperature, water | | deg C | 13 | 13 | 8 | 20 | 15 | 15 |
| Total dissolved solids | Dissolved | mg/l | | | 451 | 365 | 428 | 431 |
| Vanadium | Dissolved | ug/l | <6 | | | | | |
| Zinc | Dissolved | ug/l | 12 | | 5 | 9 | <3 | <3 |
| Zinc | Recoverable | ug/l | | | 20 | <10 | 30 | 10 |

| **Station Number**<br>**Date** | | | **07094300**<br>**11/1/1990** | **07094300**<br>**4/25/1991** | **07094300**<br>**6/20/1991** | **07094300**<br>**7/18/1991** | **07094300**<br>**10/24/1991** | **07094300**<br>**4/23/1992** |
|---|---|---|---|---|---|---|---|---|
| Alkalinity, total | Total | mg/l CaCO3 | | | | | | |
| Alpha emitting radium isotopes | Dissolved | pCi/L | | | | | | |
| Alpha particle | Dissolved | pCi/L | | | | | | |
| Alpha particle | Dissolved | ug/l | | | | | | |
| Alpha particle | Suspended | pCi/L | | | | | | |
| Alpha particle | Suspended | ug/l | | | | | | |
| Aluminum | Dissolved | ug/l | | | | | | |
| Ammonia and ammonium | Total | mg/l as N | 0.02 | 0.019 | 0.019 | 0.02 | 0.029 | 0.018 |
| Ammonia and ammonium | Total | mg/l NH4 | 0.026 | 0.024 | 0.024 | 0.026 | 0.037 | 0.023 |
| Arsenic | Dissolved | ug/l | | | | | | |
| Barium | Dissolved | ug/l | | | | | | |
| Barium | Dissolved | ug/l | | | | | | |
| Beryllium | Dissolved | ug/l | | | | | | |
| Beta particle | Dissolved | pCi/L | | | | | | |
| Beta particle | Dissolved | pCi/L | | | | | | |
| Beta particle | Suspended | pCi/L | | | | | | |
| Beta particle | Suspended | pCi/L | | | | | | |
| Cadmium | Dissolved | ug/l | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.1 |
| Cadmium | Total | ug/l | <1 | <1 | <1 | <1 | <1 | <1 |
| Calcium | Dissolved | mg/l | | | | | | |
| Carbon dioxide | Total | mg/l | | | | | | |
| Chloride | Dissolved | mg/l | | | | | | |
| Chromium | Recoverable | ug/l | | | | | | |
| Cobalt | Dissolved | ug/l | | | | | | |
| Copper | Dissolved | ug/l | 1 | 1 | 1 | <1 | <1 | <1 |
| Copper | Recoverable | ug/l | 1 | 5 | 3 | 6 | 2 | 2 |
| Gross-Uranium | Dissolved | ug/l | | | | | | |
| Hardness, Ca, Mg | | mg/l CaCO3 | | | | | | |
| Hydrogen ion | Total | mg/l | <0.001 | 0.00001 | 0.00001 | 0.00001 | <0.001 | <0.001 |
| Nitrate + Nitrite | Total | mg/l as N | 0.02 | 0.103 | 0.018 | 0.04 | 0.034 | 0.133 |
| Iron | Dissolved | ug/l | 18 | 16 | 13 | 18 | 31 | 8 |
| Iron | Recoverable | ug/l | 120 | 220 | 150 | 160 | 170 | 870 |

| **Station Number**<br>**Date** | | | **07094300**<br>**11/1/1990** | **07094300**<br>**4/25/1991** | **07094300**<br>**6/20/1991** | **07094300**<br>**7/18/1991** | **07094300**<br>**10/24/1991** | **07094300**<br>**4/23/1992** |
|---|---|---|---|---|---|---|---|---|
| Lead | Dissolved | ug/l | <0.5 | <0.5 | <0.5 | <0.5 | 0.6 | <0.5 |
| Lead | Recoverable | ug/l | <1 | 1 | 1 | 5 | 1 | <1 |
| Lithium | Dissolved | ug/l | | | | | | |
| Magnesium | Dissolved | mg/l | | | | | | |
| Manganese | Dissolved | ug/l | 39 | 38 | 73 | 120 | 62 | 60 |
| Manganese | Recoverable | ug/l | 60 | 50 | 90 | 150 | 80 | 120 |
| Molybdenum | Dissolved | ug/l | | | | | | |
| Nitrate | Total | mg/l as N | 0.02 | | | | | |
| Organic carbon | Total | mg/l | | | | | | |
| Orthophosphate | Total | mg/l as P | 0.07 | | | | | |
| Oxygen | Dissolved | mg/l | 8.6 | 8.3 | 8.5 | 7.3 | 8.7 | 9.2 |
| pH | Total | std units | 8.7 | 8.1 | 8.3 | 8.2 | 8.5 | 8.6 |
| pH | Total | std units | 8.5 | 8.2 | 8.2 | 8.2 | 8.2 | 8.4 |
| Phosphate-phosphorus | Total | mg/l | 0.215 | | | | | |
| Potassium | Dissolved | mg/l | | | | | | |
| Selenium | Dissolved | ug/l | | | | | | |
| Silica | Dissolved | mg/l | | | | | | |
| Silver | Dissolved | ug/l | | | | | | |
| Sodium | Dissolved | mg/l | | | | | | |
| Sodium adsorption ratio | | None | | | | | | |
| Sodium, percent total cations | | % | | | | | | |
| Specific conductance | Total | uS/cm @25C | 692 | 743 | 774 | 768 | 721 | 696 |
| Specific conductance | Total | uS/cm @25C | 689 | 744 | 806 | 783 | 734 | 679 |
| Stream flow, instantaneous | | ft3/s | 3.6 | 0.14 | 0.4 | 0.7 | 3.8 | 4.2 |
| Stream flow, instantaneous | | m3/sec | 0.1 | 0 | 0.01 | 0.02 | 0.11 | 0.12 |
| Strontium | Dissolved | ug/l | | | | | | |
| Sulfate | Dissolved | mg/l | | | | | | |
| Temperature, water | | deg C | 11.5 | 13 | 15 | 17.5 | 8 | 7 |
| Total dissolved solids | Dissolved | mg/l | 416 | 456 | 488 | 460 | 428 | 406 |
| Vanadium | Dissolved | ug/l | | | | | | |
| Zinc | Dissolved | ug/l | 6 | 8 | <3 | <3 | 3 | 4 |
| Zinc | Recoverable | ug/l | <10 | 10 | <10 | <10 | <10 | 20 |

Tallahassee Creek

| **Station Number** | | | **07094300** | **07094300** | **07094300** |
|---|---|---|---|---|---|
| **Date** | | | **6/26/1992** | **8/13/1992** | **10/29/1992** |
| Alkalinity, total | Total | mg/l CaCO3 | | | |
| Alpha emitting radium isotopes | Dissolved | pCi/L | | | |
| Alpha particle | Dissolved | pCi/L | | | |
| Alpha particle | Dissolved | ug/l | | | |
| Alpha particle | Suspended | pCi/L | | | |
| Alpha particle | Suspended | ug/l | | | |
| Aluminum | Dissolved | ug/l | | | |
| Ammonia and ammonium | Total | mg/l as N | 0.137 | 0.017 | 0.024 |
| Ammonia and ammonium | Total | mg/l NH4 | 0.176 | 0.022 | 0.031 |
| Arsenic | Dissolved | ug/l | | | |
| Barium | Dissolved | ug/l | | | |
| Barium | Dissolved | ug/l | | | |
| Beryllium | Dissolved | ug/l | | | |
| Beta particle | Dissolved | pCi/L | | | |
| Beta particle | Dissolved | pCi/L | | | |
| Beta particle | Suspended | pCi/L | | | |
| Beta particle | Suspended | pCi/L | | | |
| Cadmium | Dissolved | ug/l | <1 | <0.1 | <0.1 |
| Cadmium | Total | ug/l | <1 | <1 | <1 |
| Calcium | Dissolved | mg/l | | | |
| Carbon dioxide | Total | mg/l | | | |
| Chloride | Dissolved | mg/l | | | |
| Chromium | Recoverable | ug/l | | | |
| Cobalt | Dissolved | ug/l | | | |
| Copper | Dissolved | ug/l | 2 | <1 | <1 |
| Copper | Recoverable | ug/l | 20 | 1 | <1 |
| Gross-Uranium | Dissolved | ug/l | | | |
| Hardness, Ca, Mg | | mg/l CaCO3 | | | |
| Hydrogen ion | Total | mg/l | <0.001 | <0.001 | <0.001 |
| Nitrate + Nitrite | Total | mg/l as N | 0.122 | 0.055 | 0.039 |
| Iron | Dissolved | ug/l | 71 | 24 | 17 |
| Iron | Recoverable | ug/l | 7600 | 110 | 30 |

| **Station Number**<br>**Date** | | | **07094300**<br>**6/26/1992** | **07094300**<br>**8/13/1992** | **07094300**<br>**10/29/1992** |
|---|---|---|---|---|---|
| Lead | Dissolved | ug/l | <0.5 | <0.5 | <0.5 |
| Lead | Recoverable | ug/l | 4 | <1 | <1 |
| Lithium | Dissolved | ug/l | | | |
| Magnesium | Dissolved | mg/l | | | |
| Manganese | Dissolved | ug/l | 16 | 67 | 29 |
| Manganese | Recoverable | ug/l | 1800 | 80 | <10 |
| Molybdenum | Dissolved | ug/l | | | |
| Nitrate | Total | mg/l as N | | | |
| Organic carbon | Total | mg/l | | | |
| Orthophosphate | Total | mg/l as P | | | |
| Oxygen | Dissolved | mg/l | 7.7 | 7.8 | 8.6 |
| pH | Total | std units | 8.4 | 8.4 | 8.4 |
| pH | Total | std units | 7.8 | 8.4 | 8.2 |
| Phosphate-phosphorus | Total | mg/l | | | |
| Potassium | Dissolved | mg/l | | | |
| Selenium | Dissolved | ug/l | | | |
| Silica | Dissolved | mg/l | | | |
| Silver | Dissolved | ug/l | | | |
| Sodium | Dissolved | mg/l | | | |
| Sodium adsorption ratio | | None | | | |
| Sodium, percent total cations | | % | | | |
| Specific conductance | Total | uS/cm @25C | 396 | 696 | 707 |
| Specific conductance | Total | uS/cm @25C | 386 | 682 | 706 |
| Stream flow, instantaneous | | ft3/s | 32 | 0.68 | 0.2 |
| Stream flow, instantaneous | | m3/sec | 0.9 | 0.02 | 0.01 |
| Strontium | Dissolved | ug/l | | | |
| Sulfate | Dissolved | mg/l | | | |
| Temperature, water | | deg C | 14 | 17 | 10.5 |
| Total dissolved solids | Dissolved | mg/l | 220 | 402 | 411 |
| Vanadium | Dissolved | ug/l | | | |
| Zinc | Dissolved | ug/l | <3 | <3 | <3 |
| Zinc | Recoverable | ug/l | 150 | <10 | <10 |

## Tallahassee Creek

| **Station Number** | | | **382917105225200** | **382917105225200** | **382917105225200** | **382917105225200** |
|---|---|---|---|---|---|---|
| **Date** | | | **4/24/1987** | **6/3/1987** | **10/29/1987** | **4/20/1990** |
| Alkalinity, total | Total | mg/l CaCO3 | | 470 | | |
| Aluminum | Dissolved | ug/l | | 50 | | |
| Ammonia and ammonium | Total | mg/l N | | | | <0.01 |
| Ammonia and ammonium | Total | mg/l NH4 | | | | <0.013 |
| Barium | Dissolved | ug/l | | 78 | | |
| Beryllium | Dissolved | ug/l | | <0.5 | | |
| Cadmium | Dissolved | ug/l | | <1 | | <0.1 |
| Cadmium | Total | ug/l | | | | <1 |
| Calcium | Dissolved | mg/l | | 53 | | |
| Carbon dioxide | Total | mg/l | | 2.7 | | |
| Cobalt | Dissolved | ug/l | | <3 | | |
| Copper | Dissolved | ug/l | | <10 | | 1 |
| Copper | Recoverable | ug/l | | | | 3 |
| Hardness, Ca, Mg | | mg/l CaCO3 | | 228 | | |
| Hydrogen ion | Total | mg/l | <0.001 | <0.001 | <0.001 | 0.00001 |
| Nitrate + Nitrite | Total | mg/l as N | | | | 0.104 |
| Iron | Dissolved | ug/l | | 24 | | 11 |
| Iron | Recoverable | ug/l | | | | 370 |
| Lead | Dissolved | ug/l | | <10 | | <0.5 |
| Lead | Recoverable | ug/l | | | | 1 |
| Lithium | Dissolved | ug/l | | 29 | | |
| Magnesium | Dissolved | mg/l | | 23 | | |
| Manganese | Dissolved | ug/l | | 12 | | 130 |
| Manganese | Recoverable | ug/l | | | | 190 |
| Molybdenum | Dissolved | ug/l | | <10 | | |
| Nitrate | Total | mg/l as N | | | | |
| Nitrite | Total | mg/l as N | | | | |
| Organic carbon | Total | mg/l | | 5.5 | | |
| Orthophosphate | Total | mg/l as P | | | | |
| Oxygen | Dissolved | mg/l | 9.7 | | 8 | 8.6 |
| Oxygen | Dissolved | mg/l | | | | |
| pH | Total | std units | 8.9 | 8.5 | 8.9 | 8.3 |

| **Station Number** | | | **382917105225200** | **382917105225200** | **382917105225200** | **382917105225200** |
|---|---|---|---|---|---|---|
| **Date** | | | **4/24/1987** | **6/3/1987** | **10/29/1987** | **4/20/1990** |
| pH | Total | std units | | | | 8.3 |
| Phosphate-phosphorus | Total | mg/l | | | | |
| Potassium | Dissolved | mg/l | | 3.4 | | |
| Silica | Dissolved | mg/l | | 28 | | |
| Sodium | Dissolved | mg/l | | 33 | | |
| Sodium adsorption ratio | | None | | 0.95 | | |
| Sodium, percent total cations | | % | | 24 | | |
| Specific conductance | Total | uS/cm @25C | 394 | 521 | 600 | 736 |
| Specific conductance | Total | uS/cm @25C | | | | 708 |
| Stream flow, instantaneous | | ft3/s | 172 | 42 | 8.2 | 0.54 |
| Stream flow, instantaneous | | m3/sec | 4.9 | 1.2 | 0.23 | 0.02 |
| Strontium | Dissolved | ug/l | | 530 | | |
| Temperature, water | | deg C | 6.5 | 13 | 13 | 8 |
| Total dissolved solids | Dissolved | mg/l | | | | 451 |
| Vanadium | Dissolved | ug/l | | <6 | | |
| Zinc | Dissolved | ug/l | | 12 | | 5 |
| Zinc | Recoverable | ug/l | | | | 20 |

| **Station Number**<br>**Date** | | | **382917105225200**<br>**5/15/1990** | **382917105225200**<br>**5/22/1990** | **382917105225200**<br>**5/30/1990** | **382917105225200**<br>**6/5/1990** |
|---|---|---|---|---|---|---|
| Alkalinity, total | Total | mg/l CaCO3 | | | | |
| Aluminum | Dissolved | ug/l | | | | |
| Ammonia and ammonium | Total | mg/l N | | | | |
| Ammonia and ammonium | Total | mg/l NH4 | | | | |
| Barium | Dissolved | ug/l | | | | |
| Beryllium | Dissolved | ug/l | | | | |
| Cadmium | Dissolved | ug/l | | | | |
| Cadmium | Total | ug/l | | | | |
| Calcium | Dissolved | mg/l | | | | |
| Carbon dioxide | Total | mg/l | | | | |
| Cobalt | Dissolved | ug/l | | | | |
| Copper | Dissolved | ug/l | | | | |
| Copper | Recoverable | ug/l | | | | |
| Hardness, Ca, Mg | | mg/l CaCO3 | | | | |
| Hydrogen ion | Total | mg/l | | | | |
| Nitrate + Nitrite | Total | mg/l as N | | | | |
| Iron | Dissolved | ug/l | | | | |
| Iron | Recoverable | ug/l | | | | |
| Lead | Dissolved | ug/l | | | | |
| Lead | Recoverable | ug/l | | | | |
| Lithium | Dissolved | ug/l | | | | |
| Magnesium | Dissolved | mg/l | | | | |
| Manganese | Dissolved | ug/l | | | | |
| Manganese | Recoverable | ug/l | | | | |
| Molybdenum | Dissolved | ug/l | | | | |
| Nitrate | Total | mg/l as N | | | | |
| Nitrite | Total | mg/l as N | | | | |
| Organic carbon | Total | mg/l | | | | |
| Orthophosphate | Total | mg/l as P | | | | |
| Oxygen | Dissolved | mg/l | | | | |
| Oxygen | Dissolved | mg/l | | | | |
| pH | Total | std units | | | | |

| **Station Number**<br>**Date** | | | **382917105225200**<br>**5/15/1990** | **382917105225200**<br>**5/22/1990** | **382917105225200**<br>**5/30/1990** | **382917105225200**<br>**6/5/1990** |
|---|---|---|---|---|---|---|
| pH | Total | std units | | | | |
| Phosphate-phosphorus | Total | mg/l | | | | |
| Potassium | Dissolved | mg/l | | | | |
| Silica | Dissolved | mg/l | | | | |
| Sodium | Dissolved | mg/l | | | | |
| Sodium adsorption ratio | | None | | | | |
| Sodium, percent total cations | | % | | | | |
| Specific conductance | Total | uS/cm @25C | 554 | 600 | 630 | 620 |
| Specific conductance | Total | uS/cm @25C | | | | |
| Stream flow, instantaneous | | ft3/s | | | | |
| Stream flow, instantaneous | | m3/sec | | | | |
| Strontium | Dissolved | ug/l | | | | |
| Temperature, water | | deg C | | | | |
| Total dissolved solids | Dissolved | mg/l | | | | |
| Vanadium | Dissolved | ug/l | | | | |
| Zinc | Dissolved | ug/l | | | | |
| Zinc | Recoverable | ug/l | | | | |

Tallahassee Creek

| Station Number | | | 382917105225200 | 382917105225200 | 382917105225200 | 382917105225200 |
|---|---|---|---|---|---|---|
| Date | | | 6/7/1990 | 6/11/1990 | 6/24/1990 | 7/19/1990 |
| Alkalinity, total | Total | mg/l CaCO3 | | | | |
| Aluminum | Dissolved | ug/l | | | | |
| Ammonia and ammonium | Total | mg/l N | 0.03 | | | 0.03 |
| Ammonia and ammonium | Total | mg/l NH4 | 0.039 | | | 0.039 |
| Barium | Dissolved | ug/l | | | | |
| Beryllium | Dissolved | ug/l | | | | |
| Cadmium | Dissolved | ug/l | <0.1 | | | 0.1 |
| Cadmium | Total | ug/l | <1 | | | <1 |
| Calcium | Dissolved | mg/l | | | | |
| Carbon dioxide | Total | mg/l | | | | |
| Cobalt | Dissolved | ug/l | | | | |
| Copper | Dissolved | ug/l | 1 | | | 1 |
| Copper | Recoverable | ug/l | 5 | | | 7 |
| Hardness, Ca, Mg | | mg/l CaCO3 | | | | |
| Hydrogen ion | Total | mg/l | <0.001 | | | <0.001 |
| Nitrate + Nitrite | Total | mg/l as N | 0.062 | | | 0.203 |
| Iron | Dissolved | ug/l | 16 | | | 10 |
| Iron | Recoverable | ug/l | 650 | | | 6300 |
| Lead | Dissolved | ug/l | <0.5 | | | <0.5 |
| Lead | Recoverable | ug/l | 2 | | | 5 |
| Lithium | Dissolved | ug/l | | | | |
| Magnesium | Dissolved | mg/l | | | | |
| Manganese | Dissolved | ug/l | 69 | | | 120 |
| Manganese | Recoverable | ug/l | 100 | | | 360 |
| Molybdenum | Dissolved | ug/l | | | | |
| Nitrate | Total | mg/l as N | | | | |
| Nitrite | Total | mg/l as N | | | | |
| Organic carbon | Total | mg/l | | | | |
| Orthophosphate | Total | mg/l as P | | | | |
| Oxygen | Dissolved | mg/l | 7.4 | | | 7.8 |
| Oxygen | Dissolved | mg/l | | | | |
| pH | Total | std units | 8.5 | | | 8.5 |

Tallahassee Creek

| **Station Number** | | | **382917105225200** | **382917105225200** | **382917105225200** | **382917105225200** |
|---|---|---|---|---|---|---|
| **Date** | | | **6/7/1990** | **6/11/1990** | **6/24/1990** | **7/19/1990** |
| pH | Total | std units | 8.4 | | | 8.3 |
| Phosphate-phosphorus | Total | mg/l | | | | |
| Potassium | Dissolved | mg/l | | | | |
| Silica | Dissolved | mg/l | | | | |
| Sodium | Dissolved | mg/l | | | | |
| Sodium adsorption ratio | | None | | | | |
| Sodium, percent total cations | | % | | | | |
| Specific conductance | Total | uS/cm @25C | 645 | 698 | 699 | 702 |
| Specific conductance | Total | uS/cm @25C | 600 | | | 691 |
| Stream flow, instantaneous | | ft3/s | 2.6 | | | 4.7 |
| Stream flow, instantaneous | | m3/sec | 0.08 | | | 0.13 |
| Strontium | Dissolved | ug/l | | | | |
| Temperature, water | | deg C | 20 | | | 15 |
| Total dissolved solids | Dissolved | mg/l | 365 | | | 428 |
| Vanadium | Dissolved | ug/l | | | | |
| Zinc | Dissolved | ug/l | 9 | | | <3 |
| Zinc | Recoverable | ug/l | <10 | | | 30 |

## Tallahassee Creek

| Station Number | | | 382917105225200 | 382917105225200 | 382917105225200 | 382917105225200 |
|---|---|---|---|---|---|---|
| **Date** | | | **8/30/1990** | **8/31/1990** | **11/1/1990** | **4/3/1991** |
| Alkalinity, total | Total | mg/l CaCO3 | | | | |
| Aluminum | Dissolved | ug/l | | | | |
| Ammonia and ammonium | Total | mg/l N | 0.02 | | 0.02 | |
| Ammonia and ammonium | Total | mg/l NH4 | 0.026 | | 0.026 | |
| Barium | Dissolved | ug/l | | | | |
| Beryllium | Dissolved | ug/l | | | | |
| Cadmium | Dissolved | ug/l | <0.1 | | <0.1 | |
| Cadmium | Total | ug/l | <1 | | <1 | |
| Calcium | Dissolved | mg/l | | | | |
| Carbon dioxide | Total | mg/l | | | | |
| Cobalt | Dissolved | ug/l | | | | |
| Copper | Dissolved | ug/l | 1 | | 1 | |
| Copper | Recoverable | ug/l | 2 | | 1 | |
| Hardness, Ca, Mg | | mg/l CaCO3 | | | | |
| Hydrogen ion | Total | mg/l | <0.001 | | <0.001 | |
| Nitrate + Nitrite | Total | mg/l as N | 0.19 | | 0.02 | |
| Iron | Dissolved | ug/l | 15 | | 18 | |
| Iron | Recoverable | ug/l | 510 | | 120 | |
| Lead | Dissolved | ug/l | <0.5 | | <0.5 | |
| Lead | Recoverable | ug/l | 1 | | <1 | |
| Lithium | Dissolved | ug/l | | | | |
| Magnesium | Dissolved | mg/l | | | | |
| Manganese | Dissolved | ug/l | 100 | | 39 | |
| Manganese | Recoverable | ug/l | 140 | | 60 | |
| Molybdenum | Dissolved | ug/l | | | | |
| Nitrate | Total | mg/l as N | | | 0.02 | |
| Nitrite | Total | mg/l as N | | | <0.01 | |
| Organic carbon | Total | mg/l | | | | |
| Orthophosphate | Total | mg/l as P | | | 0.07 | |
| Oxygen | Dissolved | mg/l | 7.9 | | 8.6 | |
| Oxygen | Dissolved | mg/l | | | 8.6 | |
| pH | Total | std units | 8.4 | | 8.7 | |

| **Station Number**<br>**Date** | | | **382917105225200**<br>**8/30/1990** | **382917105225200**<br>**8/31/1990** | **382917105225200**<br>**11/1/1990** | **382917105225200**<br>**4/3/1991** |
|---|---|---|---|---|---|---|
| pH | Total | std units | 8.3 | | 8.5 | |
| Phosphate-phosphorus | Total | mg/l | | | 0.215 | |
| Potassium | Dissolved | mg/l | | | | |
| Silica | Dissolved | mg/l | | | | |
| Sodium | Dissolved | mg/l | | | | |
| Sodium adsorption ratio | | None | | | | |
| Sodium, percent total cations | | % | | | | |
| Specific conductance | Total | uS/cm @25C | 699 | 673 | 692 | 726 |
| Specific conductance | Total | uS/cm @25C | 698 | | 689 | |
| Stream flow, instantaneous | | ft3/s | 2.8 | | 3.6 | |
| Stream flow, instantaneous | | m3/sec | 0.08 | | 0.1 | |
| Strontium | Dissolved | ug/l | | | | |
| Temperature, water | | deg C | 15 | | 11.5 | |
| Total dissolved solids | Dissolved | mg/l | 431 | | 416 | |
| Vanadium | Dissolved | ug/l | | | | |
| Zinc | Dissolved | ug/l | <3 | | 6 | |
| Zinc | Recoverable | ug/l | 10 | | <10 | |

| **Station Number**<br>**Date** | | | **382917105225200**<br>**4/25/1991** | **382917105225200**<br>**5/8/1991** | **382917105225200**<br>**5/16/1991** | **382917105225200**<br>**6/12/1991** |
|---|---|---|---|---|---|---|
| Alkalinity, total | Total | mg/l CaCO3 | | | | |
| Aluminum | Dissolved | ug/l | | | | |
| Ammonia and ammonium | Total | mg/l N | 0.019 | | | |
| Ammonia and ammonium | Total | mg/l NH4 | 0.024 | | | |
| Barium | Dissolved | ug/l | | | | |
| Beryllium | Dissolved | ug/l | | | | |
| Cadmium | Dissolved | ug/l | <0.1 | | | |
| Cadmium | Total | ug/l | <1 | | | |
| Calcium | Dissolved | mg/l | | | | |
| Carbon dioxide | Total | mg/l | | | | |
| Cobalt | Dissolved | ug/l | | | | |
| Copper | Dissolved | ug/l | 1 | | | |
| Copper | Recoverable | ug/l | 5 | | | |
| Hardness, Ca, Mg | | mg/l CaCO3 | | | | |
| Hydrogen ion | Total | mg/l | 0.00001 | | | |
| Nitrate + Nitrite | Total | mg/l as N | 0.103 | | | |
| Iron | Dissolved | ug/l | 16 | | | |
| Iron | Recoverable | ug/l | 220 | | | |
| Lead | Dissolved | ug/l | 0.5 | | | |
| Lead | Recoverable | ug/l | 1 | | | |
| Lithium | Dissolved | ug/l | | | | |
| Magnesium | Dissolved | mg/l | | | | |
| Manganese | Dissolved | ug/l | 38 | | | |
| Manganese | Recoverable | ug/l | 50 | | | |
| Molybdenum | Dissolved | ug/l | | | | |
| Nitrate | Total | mg/l as N | | | | |
| Nitrite | Total | mg/l as N | | | | |
| Organic carbon | Total | mg/l | | | | |
| Orthophosphate | Total | mg/l as P | | | | |
| Oxygen | Dissolved | mg/l | 8.3 | | | |
| Oxygen | Dissolved | mg/l | | | | |
| pH | Total | std units | 8.1 | | | |

| **Station Number** | | | **382917105225200** | **382917105225200** | **382917105225200** | **382917105225200** |
|---|---|---|---|---|---|---|
| **Date** | | | **4/25/1991** | **5/8/1991** | **5/16/1991** | **6/12/1991** |
| pH | Total | std units | 8.2 | | | |
| Phosphate-phosphorus | Total | mg/l | | | | |
| Potassium | Dissolved | mg/l | | | | |
| Silica | Dissolved | mg/l | | | | |
| Sodium | Dissolved | mg/l | | | | |
| Sodium adsorption ratio | | None | | | | |
| Sodium, percent total cations | | % | | | | |
| Specific conductance | Total | uS/cm @25C | 743 | 752 | 758 | 735 |
| Specific conductance | Total | uS/cm @25C | 744 | | | |
| Stream flow, instantaneous | | ft3/s | 0.14 | | | |
| Stream flow, instantaneous | | m3/sec | 0 | | | |
| Strontium | Dissolved | ug/l | | | | |
| Temperature, water | | deg C | 13 | | | |
| Total dissolved solids | Dissolved | mg/l | 456 | | | |
| Vanadium | Dissolved | ug/l | | | | |
| Zinc | Dissolved | ug/l | 8 | | | |
| Zinc | Recoverable | ug/l | 10 | | | |

| **Station Number**<br>**Date** | | | **382917105225200**<br>**6/20/1991** | **382917105225200**<br>**6/25/1991** | **382917105225200**<br>**7/18/1991** | **382917105225200**<br>**7/31/1991** |
|---|---|---|---|---|---|---|
| Alkalinity, total | Total | mg/l CaCO3 | | | | |
| Aluminum | Dissolved | ug/l | | | | |
| Ammonia and ammonium | Total | mg/l N | 0.019 | | 0.02 | |
| Ammonia and ammonium | Total | mg/l NH4 | 0.024 | | 0.026 | |
| Barium | Dissolved | ug/l | | | | |
| Beryllium | Dissolved | ug/l | | | | |
| Cadmium | Dissolved | ug/l | <0.1 | | <0.1 | |
| Cadmium | Total | ug/l | <1 | | <1 | |
| Calcium | Dissolved | mg/l | | | | |
| Carbon dioxide | Total | mg/l | | | | |
| Cobalt | Dissolved | ug/l | | | | |
| Copper | Dissolved | ug/l | 1 | | <1 | |
| Copper | Recoverable | ug/l | 3 | | 6 | |
| Hardness, Ca, Mg | | mg/l CaCO3 | | | | |
| Hydrogen ion | Total | mg/l | 0.00001 | | 0.00001 | |
| Nitrate + Nitrite | Total | mg/l as N | 0.018 | | 0.04 | |
| Iron | Dissolved | ug/l | 13 | | 18 | |
| Iron | Recoverable | ug/l | 150 | | 160 | |
| Lead | Dissolved | ug/l | <0.5 | | <0.5 | |
| Lead | Recoverable | ug/l | 1 | | 5 | |
| Lithium | Dissolved | ug/l | | | | |
| Magnesium | Dissolved | mg/l | | | | |
| Manganese | Dissolved | ug/l | 73 | | 120 | |
| Manganese | Recoverable | ug/l | 90 | | 150 | |
| Molybdenum | Dissolved | ug/l | | | | |
| Nitrate | Total | mg/l as N | | | | |
| Nitrite | Total | mg/l as N | | | | |
| Organic carbon | Total | mg/l | | | | |
| Orthophosphate | Total | mg/l as P | | | | |
| Oxygen | Dissolved | mg/l | 8.5 | | 7.3 | |
| Oxygen | Dissolved | mg/l | | | | |
| pH | Total | std units | 8.3 | | 8.2 | |

| **Station Number**<br>**Date** | | | **382917105225200**<br>**6/20/1991** | **382917105225200**<br>**6/25/1991** | **382917105225200**<br>**7/18/1991** | **382917105225200**<br>**7/31/1991** |
|---|---|---|---|---|---|---|
| pH | Total | std units | 8.2 | | 8.2 | |
| Phosphate-phosphorus | Total | mg/l | | | | |
| Potassium | Dissolved | mg/l | | | | |
| Silica | Dissolved | mg/l | | | | |
| Sodium | Dissolved | mg/l | | | | |
| Sodium adsorption ratio | | None | | | | |
| Sodium, percent total cations | | % | | | | |
| Specific conductance | Total | uS/cm @25C | 774 | 728 | 768 | 740 |
| Specific conductance | Total | uS/cm @25C | 806 | | 783 | |
| Stream flow, instantaneous | | ft3/s | 0.4 | | 0.7 | |
| Stream flow, instantaneous | | m3/sec | 0.01 | | 0.02 | |
| Strontium | Dissolved | ug/l | | | | |
| Temperature, water | | deg C | 15 | | 17.5 | |
| Total dissolved solids | Dissolved | mg/l | 488 | | 460 | |
| Vanadium | Dissolved | ug/l | | | | |
| Zinc | Dissolved | ug/l | <3 | | <3 | |
| Zinc | Recoverable | ug/l | <10 | | <10 | |

Tallahassee Creek

| **Station Number**<br>**Date** | | | **382917105225200**<br>**10/24/1991** | **382917105225200**<br>**3/12/1992** | **382917105225200**<br>**3/24/1992** | **382917105225200**<br>**4/6/1992** |
|---|---|---|---|---|---|---|
| Alkalinity, total | Total | mg/l CaCO3 | | | | |
| Aluminum | Dissolved | ug/l | | | | |
| Ammonia and ammonium | Total | mg/l N | 0.029 | | | |
| Ammonia and ammonium | Total | mg/l NH4 | 0.037 | | | |
| Barium | Dissolved | ug/l | | | | |
| Beryllium | Dissolved | ug/l | | | | |
| Cadmium | Dissolved | ug/l | <0.1 | | | |
| Cadmium | Total | ug/l | <1 | | | |
| Calcium | Dissolved | mg/l | | | | |
| Carbon dioxide | Total | mg/l | | | | |
| Cobalt | Dissolved | ug/l | | | | |
| Copper | Dissolved | ug/l | <1 | | | |
| Copper | Recoverable | ug/l | 2 | | | |
| Hardness, Ca, Mg | | mg/l CaCO3 | | | | |
| Hydrogen ion | Total | mg/l | <0.001 | | | |
| Nitrate + Nitrite | Total | mg/l as N | 0.034 | | | |
| Iron | Dissolved | ug/l | 31 | | | |
| Iron | Recoverable | ug/l | 170 | | | |
| Lead | Dissolved | ug/l | 0.6 | | | |
| Lead | Recoverable | ug/l | 1 | | | |
| Lithium | Dissolved | ug/l | | | | |
| Magnesium | Dissolved | mg/l | | | | |
| Manganese | Dissolved | ug/l | 62 | | | |
| Manganese | Recoverable | ug/l | 80 | | | |
| Molybdenum | Dissolved | ug/l | | | | |
| Nitrate | Total | mg/l as N | | | | |
| Nitrite | Total | mg/l as N | | | | |
| Organic carbon | Total | mg/l | | | | |
| Orthophosphate | Total | mg/l as P | | | | |
| Oxygen | Dissolved | mg/l | 8.7 | | | |
| Oxygen | Dissolved | mg/l | | | | |
| pH | Total | std units | 8.5 | | | |

| **Station Number**<br>**Date** | | | **382917105225200**<br>**10/24/1991** | **382917105225200**<br>**3/12/1992** | **382917105225200**<br>**3/24/1992** | **382917105225200**<br>**4/6/1992** |
|---|---|---|---|---|---|---|
| pH | Total | std units | 8.2 | | | |
| Phosphate-phosphorus | Total | mg/l | | | | |
| Potassium | Dissolved | mg/l | | | | |
| Silica | Dissolved | mg/l | | | | |
| Sodium | Dissolved | mg/l | | | | |
| Sodium adsorption ratio | | None | | | | |
| Sodium, percent total cations | | % | | | | |
| Specific conductance | Total | uS/cm @25C | 721 | 699 | 701 | 688 |
| Specific conductance | Total | uS/cm @25C | 734 | | | |
| Stream flow, instantaneous | | ft3/s | 3.8 | | | |
| Stream flow, instantaneous | | m3/sec | 0.11 | | | |
| Strontium | Dissolved | ug/l | | | | |
| Temperature, water | | deg C | 8 | | | |
| Total dissolved solids | Dissolved | mg/l | 4.33 | | | |
| Vanadium | Dissolved | ug/l | | | | |
| Zinc | Dissolved | ug/l | 3 | | | |
| Zinc | Recoverable | ug/l | <10 | | | |

# Tallahassee Creek

| **Station Number** | | | **382917105225200** | **382917105225200** | **382917105225200** | **382917105225200** |
|---|---|---|---|---|---|---|
| **Date** | | | **4/10/1992** | **4/14/1992** | **4/23/1992** | **5/22/1992** |
| Alkalinity, total | Total | mg/l CaCO3 | | | | |
| Aluminum | Dissolved | ug/l | | | | |
| Ammonia and ammonium | Total | mg/l N | | | 0.018 | |
| Ammonia and ammonium | Total | mg/l NH4 | | | 0.023 | |
| Barium | Dissolved | ug/l | | | | |
| Beryllium | Dissolved | ug/l | | | | |
| Cadmium | Dissolved | ug/l | | | 0.1 | |
| Cadmium | Total | ug/l | | | <1 | |
| Calcium | Dissolved | mg/l | | | | |
| Carbon dioxide | Total | mg/l | | | | |
| Cobalt | Dissolved | ug/l | | | | |
| Copper | Dissolved | ug/l | | | <1 | |
| Copper | Recoverable | ug/l | | | 2 | |
| Hardness, Ca, Mg | | mg/l CaCO3 | | | | |
| Hydrogen ion | Total | mg/l | | | <0.001 | |
| Nitrate + Nitrite | Total | mg/l as N | | | 0.133 | |
| Iron | Dissolved | ug/l | | | 8 | |
| Iron | Recoverable | ug/l | | | 870 | |
| Lead | Dissolved | ug/l | | | <0.5 | |
| Lead | Recoverable | ug/l | | | <1 | |
| Lithium | Dissolved | ug/l | | | | |
| Magnesium | Dissolved | mg/l | | | | |
| Manganese | Dissolved | ug/l | | | 60 | |
| Manganese | Recoverable | ug/l | | | 120 | |
| Molybdenum | Dissolved | ug/l | | | | |
| Nitrate | Total | mg/l as N | | | | |
| Nitrite | Total | mg/l as N | | | | |
| Organic carbon | Total | mg/l | | | | |
| Orthophosphate | Total | mg/l as P | | | | |
| Oxygen | Dissolved | mg/l | | | 9.2 | |
| Oxygen | Dissolved | mg/l | | | | |
| pH | Total | std units | | | 8.6 | |

Tallahassee Creek

| Station Number<br>Date | | | 382917105225200<br>4/10/1992 | 382917105225200<br>4/14/1992 | 382917105225200<br>4/23/1992 | 382917105225200<br>5/22/1992 |
|---|---|---|---|---|---|---|
| pH | Total | std units | | | 8.4 | |
| Phosphate-phosphorus | Total | mg/l | | | | |
| Potassium | Dissolved | mg/l | | | | |
| Silica | Dissolved | mg/l | | | | |
| Sodium | Dissolved | mg/l | | | | |
| Sodium adsorption ratio | | None | | | | |
| Sodium, percent total cations | | % | | | | |
| Specific conductance | Total | uS/cm @25C | 702 | 741 | 696 | 714 |
| Specific conductance | Total | uS/cm @25C | | | 679 | |
| Stream flow, instantaneous | | ft3/s | | | 4.2 | |
| Stream flow, instantaneous | | m3/sec | | | 0.12 | |
| Strontium | Dissolved | ug/l | | | | |
| Temperature, water | | deg C | | | 7 | |
| Total dissolved solids | Dissolved | mg/l | | | 4.65 | |
| Vanadium | Dissolved | ug/l | | | | |
| Zinc | Dissolved | ug/l | | | 4 | |
| Zinc | Recoverable | ug/l | | | 20 | |

Tallahassee Creek

| **Station Number**<br>**Date** | | | **382917105225200**<br>**6/9/1992** | **382917105225200**<br>**6/26/1992** | **382917105225200**<br>**8/13/1992** | **382917105225200**<br>**10/29/1992** |
|---|---|---|---|---|---|---|
| Alkalinity, total | Total | mg/l CaCO3 | | | | |
| Aluminum | Dissolved | ug/l | | | | |
| Ammonia and ammonium | Total | mg/l N | | 0.137 | 0.017 | 0.024 |
| Ammonia and ammonium | Total | mg/l NH4 | | 0.176 | 0.022 | 0.031 |
| Barium | Dissolved | ug/l | | | | |
| Beryllium | Dissolved | ug/l | | | | |
| Cadmium | Dissolved | ug/l | | <0.1 | <0.1 | <0.1 |
| Cadmium | Total | ug/l | | <1 | <1 | <1 |
| Calcium | Dissolved | mg/l | | | | |
| Carbon dioxide | Total | mg/l | | | | |
| Cobalt | Dissolved | ug/l | | | | |
| Copper | Dissolved | ug/l | | 2 | <1 | <1 |
| Copper | Recoverable | ug/l | | 20 | 1 | <1 |
| Hardness, Ca, Mg | | mg/l CaCO3 | | | | |
| Hydrogen ion | Total | mg/l | | <0.001 | <0.001 | <0.001 |
| Nitrate + Nitrite | Total | mg/l as N | | 0.122 | 0.055 | 0.039 |
| Iron | Dissolved | ug/l | | 71 | 24 | 17 |
| Iron | Recoverable | ug/l | | 7600 | 110 | 30 |
| Lead | Dissolved | ug/l | | <0.5 | <0.5 | <0.5 |
| Lead | Recoverable | ug/l | | 4 | <1 | <1 |
| Lithium | Dissolved | ug/l | | | | |
| Magnesium | Dissolved | mg/l | | | | |
| Manganese | Dissolved | ug/l | | 16 | 67 | 29 |
| Manganese | Recoverable | ug/l | | 1800 | 80 | <10 |
| Molybdenum | Dissolved | ug/l | | | | |
| Nitrate | Total | mg/l as N | | | | |
| Nitrite | Total | mg/l as N | | | | |
| Organic carbon | Total | mg/l | | | | |
| Orthophosphate | Total | mg/l as P | | | | |
| Oxygen | Dissolved | mg/l | | 7.7 | 7.8 | 8.6 |
| Oxygen | Dissolved | mg/l | | | | |
| pH | Total | std units | | 8.4 | 8.4 | 8.4 |

Tallahassee Creek

| **Station Number**<br>**Date** | | | **382917105225200**<br>**6/9/1992** | **382917105225200**<br>**6/26/1992** | **382917105225200**<br>**8/13/1992** | **382917105225200**<br>**10/29/1992** |
|---|---|---|---|---|---|---|
| pH | Total | std units | | 7.8 | 8.4 | 8.2 |
| Phosphate-phosphorus | Total | mg/l | | | | |
| Potassium | Dissolved | mg/l | | | | |
| Silica | Dissolved | mg/l | | | | |
| Sodium | Dissolved | mg/l | | | | |
| Sodium adsorption ratio | | None | | | | |
| Sodium, percent total cations | | % | | | | |
| Specific conductance | Total | uS/cm @25C | 683 | 396 | 696 | 707 |
| Specific conductance | Total | uS/cm @25C | | 386 | 682 | 706 |
| Stream flow, instantaneous | | ft3/s | | 32 | 0.68 | 0.2 |
| Stream flow, instantaneous | | m3/sec | | 0.9 | 0.02 | 0.01 |
| Strontium | Dissolved | ug/l | | | | |
| Temperature, water | | deg C | | 14 | 17 | 10.5 |
| Total dissolved solids | Dissolved | mg/l | | 18.8 | 0.74 | 0.22 |
| Vanadium | Dissolved | ug/l | | | | |
| Zinc | Dissolved | ug/l | | <3 | <3 | <3 |
| Zinc | Recoverable | ug/l | | 150 | <10 | <10 |

Martin Marietta Parkdale Quarry: Field Water Quality

| | n/a | Date | Temperature | DO | Specific Conductance | pH | ORP | Turbidity |
|---|---|---|---|---|---|---|---|---|
| | Regulation/Well Name | Units | Deg C | mg/L | µS/ms | n/a | ReL. | NTU |
| | Domestic Water Supply | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| | Aquatic Life Acute | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| | Aquatic Life Chronic | n/a | n/a | 3 | n/a | 6.5-9.0 | n/a | n/a |
| 1 | Well 1 | 12/11/2018 | 14.68 | 4.37 | 587 | 7.71 | 127 | 743 |
| 2 | Well 1 | 5/14/2019 | 20.26 | 3.98 | 475 | 7.16 | 127 | 920 |
| 3 | Well 3 | 12/11/2018 | 16.4 | 0.95 | 480 | 7.65 | 88.5 | > 1000 |
| 4 | Well 3 | 5/13/2019 | 17.0 | 6.41 | 379 | 7.12 | 70 | 821 |
| 5 | Well 3 | 8/28/2019 | 18.0 | 1.18 | 411 | 7.13 | 9 | 24.2 |
| 6 | Well 10 | 12/12/2018 | 13.43 | 4.2 | 602 | 7.55 | 48.7 | > 1000 |
| 7 | Well 10 | 5/13/2019 | 12.86 | 5.05 | 480 | 6.64 | 110 | 478 |
| 8 | Well 10 | 8/28/2019 | 14.71 | 4.87 | 617 | 6.91 | 64 | 330 |

Colorado Department of Public Health and Environment Water Quality Control Commission
Regulation No. 31 - The Basic Standards and Methodologies for Surface Water
https://www.colorado.gov/pacific/sites/default/files/31_2018%2801%29.pdf
* aquatic life fomulas based on mean hardness of 200 mg/L CaCO3
Exceeds Domestic Water Supply Regulations

Martin Marietta Parkdale Quarry: Major Ions and Metals

| n/a | Date | Alkalinity, Total as CaCO3 | Chloride | Nitrogen, Nitrate | Phosphorus, Total | Solids, Total Dissolved | Sulfate | Aluminum | Antimony | Arsenic | Barium | Cadmium | Calcium | Chromium | Cobalt a | Copper | Iron | Lead | Magnesium | Manganese | Molybdenum | Nickel | Potassium | Selenium | Silicon | Sodium | Uranium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Regulation/Well Name | Units | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| Domestic Water Supply | n/a | n/a | 250 | 10 | n/a | 500 | 250 | n/a | 6 | 10 | 1000 | 5 | n/a | 50 | n/a | 200 | 300 | 50 | n/a | 50 | 210 | 100 | n/a | 50 | n/a | n/a | 30 | 5000 |
| Aquatic Life Acute | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 8838* | n/a | 340 | n/a | 5* | n/a | 16* | n/a | 26* | | 136* | n/a | 3761* | 300 | 842* | n/a | 18.4 | n/a | n/a | 5157* | 301* |
| Aquatic Life Chronic | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 1262* | n/a | 150 | n/a | 0.72* | n/a | 11* | n/a | 16* | | 5.3* | n/a | 2078* | n/a | 94* | n/a | 4.6 | n/a | n/a | 3221* | 228* |
| Well 1 | 12/11/2018 | 190 | 8 | 5.7 | 0.28 | 406 | 99 | < 100 | < 0.80 | < 0.40 | 18.3 | < 0.20 | 67600 | < 4.0 | < 2.0 | < 4.0 | 179 | < 1.0 | 15800 | 5 | 40 | 5.2 | 2900 | 2.9 | 7660 | 23700 | 17.3 | < 20 |
| Well 1 | 5/14/2019 | 188 | 7.5 | 6.5 | 0.31 | 417 | 95.8 | < 100 | < 0.80 | 0.4 | 20.7 | < 0.20 | 75800 | < 4.0 | < 1.0 a | < 4.0 | 122 | < 1.0 | 15100 | 2.9 | 18.8 | < 4.0 | 3030 | 3.8 | 7640 | 23100 | 13.7 | < 20 |
| Well 3 | 12/11/2018 | 176 | 11.6 | 1.9 | 0.98 | 338 | 63.2 | < 100 | < 0.80 | 0.59 | 31.4 | < 0.20 | 50200 | < 4.0 | < 0.40 | < 4.0 | 139 | < 1.0 | 11400 | 9.8 | 141 | < 4.0 | 2360 | 3.2 | 9950 | 30700 | 21.2 | < 20 |
| Well 3 | 5/13/2019 | 168 | 9.9 | 2.6 | 0.41 | 318 | 55.7 | < 100 | < 0.80 | 0.43 | 18.9 | < 0.20 | 48100 | < 4.0 | < 0.40 | < 4.0 | 82.2 | < 1.0 | 10600 | 12.8 | 155 | 11.2 | 2130 | 2.2 | 10700 | 28200 | 19.7 | < 20 |
| Well 3 | 8/28/2019 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 16.7 | n/a |
| Well 10 | 12/12/2018 | 253 | 8 | 0.12 | 3.1 | 437 | 86.3 | < 100 | < 0.80 | 0.42 | 39.1 | < 0.20 | 81400 | < 4.0 | < 2.0 | 8.4 | 221 | < 1.0 | 16500 | 24.1 | 38.3 | 10.2 | 2550 | 1.2 | 13000 | 22600 | 38.2 | < 20 |
| Well 10 | 5/13/2019 | 228 | 7.5 | 0.087 | 0.81 | 420 | 85.9 | < 100 | < 0.80 | 0.4 | 34 | < 0.20 | 76400 | < 4.0 | < 2.0 a | 5.2 | 140 | < 1.0 | 14800 | 5 | 7.3 | < 4.0 | 1640 | 1.2 | 13200 | 20000 | 16.7 | < 20 |
| Well 10 | 8/28/2019 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 12.6 | n/a |

Colorado Department of Public Health and Environment Water Quality Control Commission
Regulation No. 31 - The Basic Standards and Methodologies for Surface Water
https://www.colorado.gov/pacific/sites/default/files/31_2018%2801%29.pdf
* aquatic life fomulas based on mean hardness of 200 mg/L CaCO3
Exceeds Domestic Water Supply Regulations

Martin Marietta Parkdale Quarry: Radionuclides

| n/a | Date | Gross Alpha | Gross Beta | Radium 226 | Radium 228 | Uranium 234 | Uranium 235 | Uranium 238 |
|---|---|---|---|---|---|---|---|---|
| Regulation/Well Name | Units | pCi/L | pCi/L | pCi/L | pCi/L | pCi/L | pCi/L | pCi/L |
| Domestic Water Supply | n/a | 15 | 4 mrems per year (50 pCi/L screening) | 5 (226 and 228 combined) | 5 (226 and 228 combined) | 30 | 30 | 30 |
| Aquatic Life Acute | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Aquatic Life Chronic | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| Well 1 | 12/11/2018 | 19 | 22 | 1 | 1.5 | 16 | 0.07 | 9.06 |
| Well 1 | 5/14/2019 | 18 | 28 | 1.2 | 2.7 | 19 | 0 | 6.45 |
| Well 3 | 12/11/2018 | 47 | 71 | 2.3 | 2.2 | 21 | 1.2 | 9.99 |
| Well 3 | 5/13/2019 | 47 | 65 | 1.3 | 9.7 | 17 | -0.27 | 7.28 |
| Well 3 | 8/28/2019 | 38 | 14 | n/a | n/a | n/a | n/a | n/a |
| Well 10 | 12/12/2018 | 120 | 200 | 4.4 | 3.1 | 25 | 0.96 | 17.2 |
| Well 10 | 5/13/2019 | 25 | 34 | 1.4 | 2.6 | 11 | -0.64 | 7.44 |
| Well 10 | 8/28/2019 | 31 | 20 | n/a | n/a | n/a | n/a | n/a |

Colorado Department of Public Health and Environment Water Quality Control Commission
Regulation No. 31 - The Basic Standards and Methodologies for Surface Water
https://www.colorado.gov/pacific/sites/default/files/31_2018%2801%29.pdf
* aquatic life fomulas based on mean hardness of 200 mg/L CaCO3
Exceeds Domestic Water Supply Regulations

Whetstone Associates

# Technical Memorandum

| | | |
|---|---|---|
| **To:** | Scott Duncan (ICF) | **4189A** |
| **From:** | Susan Wyman, P.E., P.G. (Whetstone Associates) | |
| **Date:** | January 15, 2020 | |
| **Subject:** | Runoff Modeling, Parkdale Quarry Project | |

Potential impacts to surface water flow rates in Currant Creek and Tallahassee Creek resulting from proposed mining at the Parkdale Quarry Project were evaluated using the Natural Resources Conservation Service (NRCS) TR-55 method and HydroCAD® modeling software. The models estimate the surface water runoff from the proposed quarry expansion area (Sale Area) under existing conditions, which are then compared to the potential runoff after mining and reclamation.

## 1. SITE DESCRIPTION

### 1.1 Surface Water Flow

The Sale Area is located on the flank of Cactus Mountain and drains southwest toward Currant Creek and Tallahassee Creek. All drainages within the proposed pit disturbance are intermittent or ephemeral and flow for limited periods during most years in response to direct precipitation and snowmelt.

The proposed mining operation would remove vegetation and overburden soils to expose the granite deposit. Granite would be blasted, excavated, and hauled to an existing onsite processing facility. Final reclamation of the Sale Area would create a landscape that substantially mimics the landscape in Webster Park, south of and bordering the Sale Area. After mining is complete, the topography of the quarry would generally slope in the same direction and drainage channels would be excavated into the quarry floor to maintain the current general patterns of runoff. The drainage channels would be constructed with a channel profile and sinuosity similar to that of natural drainages in Webster Park that feed into the south side of the Arkansas River.

### 1.2 Precipitation

Lower areas of the watershed receive about 13 inches of annual precipitation and higher elevation areas receive about 19 inches, with most of the rainfall events occurring in July and August. The average precipitation at the site is about 17 inches annually (BLM 2017) with recharge to groundwater being estimated to be about 0.16 inches per year (ERM 2019).

The precipitation frequency (magnitude and recurrence interval) of storms for the site are shown in Table 1. The rainfall intensity for 24-hour storms with 2-year to 100-year recurrence intervals were interpolated from the online NOAA Atlas 14, Vol. 8, version 2 (NOAA 2020, Attachment 1), for the purpose of runoff calculations.

*Table 1. Design Storm Parameters*

| Recurrence Interval | Duration (Hours) | Storm Magnitude NOAA Atlas (inches) |
|---|---|---|
| 100-year | 24 | 4.35 |
| 50-year | 24 | 3.73 |
| 25-year | 24 | 3.17 |
| 10-year | 24 | 2.52 |
| 5-year | 24 | 2.12 |
| 2-year | 24 | 1.69 |

Rainfall is assumed to follow the 24-hr Type II rainfall-time distribution curve which is applicable to this area of the United States (USDC, 1973).

### 1.3 Hydrologic Characteristics of Local Soils

The dominant soils in the Sales Area are Ustic Torriorthents, which are shown as soil type 120 in Figure 1. Additionally, the southern third of the drainages are mapped as the Roygorge very gravelly sandy clay loam, shown as soil type 98 in Figure 1 and Table 2. Soils in the lower reaches of the drainages, just north of Tallahassee Creek, are mapped as Shanta loam (104), Kim loam (50), Louviers-Travessilla complex (64), Otero fine sandy loam (81), and Riverwash (92) (Attachment 2).

The Ustic Torriorthents and Roygorge gravelly sandy clay loam occupy the majority of the area and are mapped as Hydrologic Soil Group D. Much smaller areas are mapped as Hydrologic Group A and Group B. These soil groups are defined by the NRCS (2007) as:

> ***Group A.*** *Soils having a low runoff potential (high infiltration rate) when thoroughly wet. Water is transmitted freely through the soil.*
>
> ***Group B.*** *Soils having a moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded. Group B soils typically have between 10 percent and 20 percent clay and 50 percent to 90 percent sand and have loamy sand or sandy loam textures.*
>
> ***Group C.*** *Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.*
>
> ***Group D.*** *Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. Water movement through the soil is restricted or very restricted. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.*

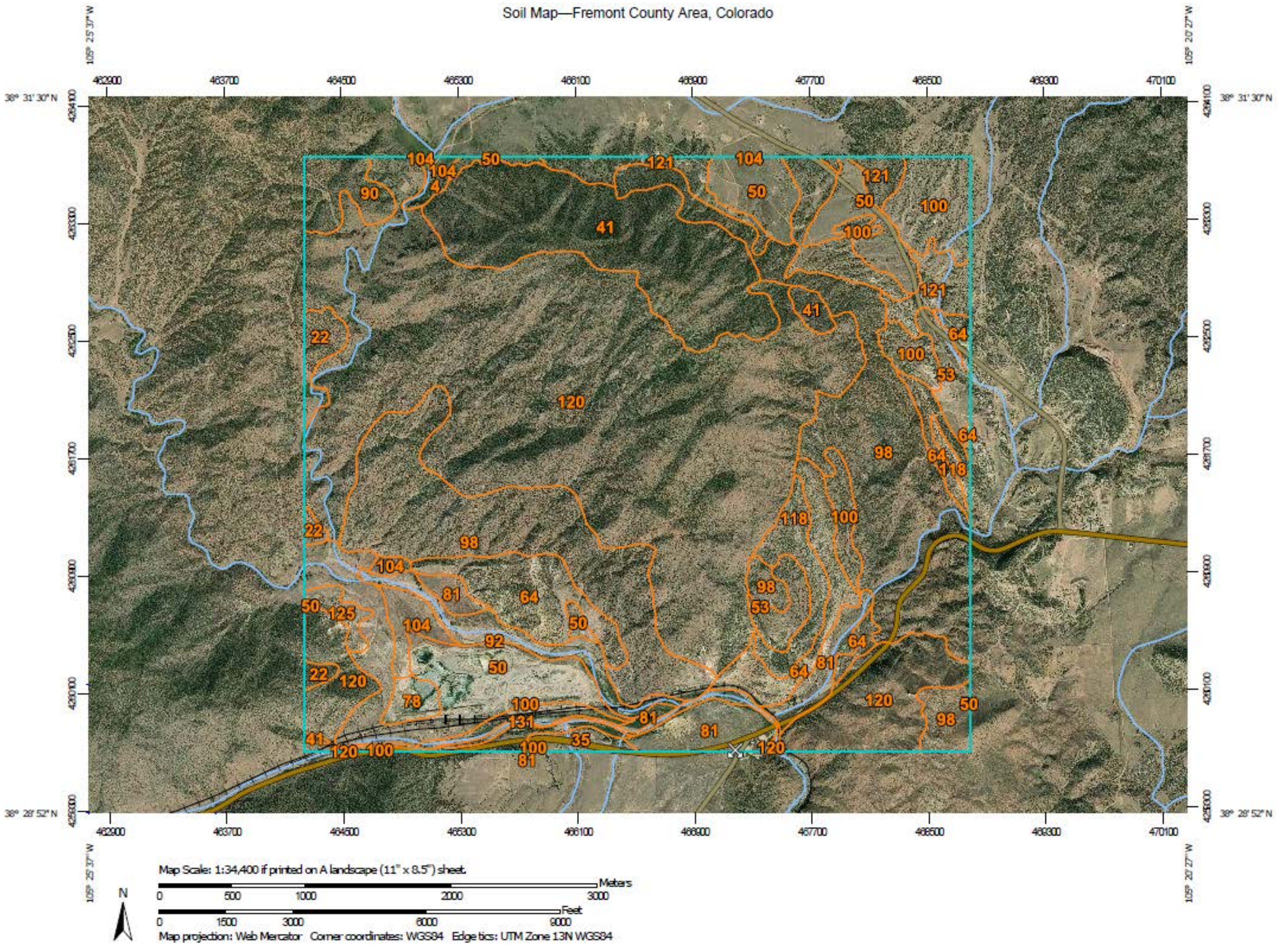

Soil Map—Fremont County Area, Colorado
Map Scale: 1:34,400 if printed on A landscape (11" x 8.5") sheet.
Meters
Feet
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

*Figure 1. Soil Map*

*Table 2. Soils Types in Vicinity of the Sales Area*

| Map Unit Symbol | Map Unit Name | Acres in AOI | Hydrologic Group |
|---|---|---|---|
| 50 | Kim loam, cool, 3 to 8 percent slopes | 377.8 | B |
| 64 | Louviers-Travessilla complex, 20 to 50 percent slopes | 252.2 | D |
| 81 | Otero fine sandy loam, 3 to 8 percent slopes | 132.2 | A |
| 92 | Riverwash | 71.9 | n/a |
| 98 | Roygorge very gravelly sandy clay loam, 25 to 50 percent slopes | 849.9 | D |
| 104 | Shanta loam, 0 to 3 percent slopes | 45.4 | B |
| 120 | Ustic Torriorthents, bouldery-Rock outcrop complex, 35 to 90 percent slopes | 1,712.70 | D |

The runoff curve numbers for the model were selected based on soil type, land use, and vegetative cover. A curve number of 75 was applied for pinyon-juniper with grass understory, in fair to good condition (30-70% vegetative cover) and group D soils (Table 3). A curve number of 89 was applied to areas revegetated with an herbaceous mixture of grasses, weeds, and low-lying brush in fair condition. Site curve numbers are summarized in Table 4.

***Table 3. Runoff Curve Numbers for Arid and Semi-Arid Rangelands***

***(Table 2-2d of TR-55 [NRCS, 1986])***

| **Cover Description** [(1)] | | **Curve Numbers for Hydrologic Soil Group** | | | |
|---|---|---|---|---|---|
| **Cover Type** | **Hydrologic Condition** [(2)] | **A** | **B** | **C** | **D** |
| Herbaceous-mixture of grass, weeds, and low-growing brush, with brush the minor element | Poor | | 80 | 87 | 93 |
| | Fair | | 71 | 81 | **89** |
| | Good | | 62 | 74 | 85 |
| Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush | Poor | | 66 | 74 | 79 |
| | Fair | | 48 | 57 | 63 |
| | Good | | 30 | 41 | 48 |
| Pinyon-juniper—pinyon, juniper, or both; grass understory | Poor | | 75 | 85 | 89 |
| | Fair | | 58 | 73 | **80** |
| | Good | | 41 | 61 | **71** |
| Sagebrush with grass understory | Poor | | 67 | 80 | 85 |
| | Fair | | 51 | 63 | 70 |
| | Good | | 35 | 47 | 55 |
| Desert shrub—major plants include saltbush, greasewood, creosote bush, blackbrush, bursage, palo verde, mesquite, and cactus | Poor | 63 | 77 | 85 | 88 |
| | Fair | 55 | 72 | 81 | 86 |
| | Good | 49 | 68 | 79 | 84 |
| Gravel Road [(3)] | | 76 | 85 | 89 | 91 |

Notes:

[(1)] Based on average runoff condition, and Ia, = 0.2S.

[(2)] Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.

[(3)] Source for gravel road CN is Table 2-2a of TR-55 (NRCS 1986)

***Table 4. Runoff Curve Numbers for Parkdale Quarry Sales Area***

| **Description** | **CN** |
|---|---|
| Pinyon-juniper, grass understory, fair to good condition, Group D soils | 75 |
| Herbaceous mixture of grasses, weeds, low-lying brush, fair condition (revegetated) | 89 |

## 1.4 Approach for Evaluation of Surface Water Impacts

Pre-mining and post-mining runoff rates were computed to evaluate the relative changes in surface water flow resulting from mining disturbance (changes in slope, stream lengths, and vegetation). Four drainages were simulated in the pre-mining condition (Figure 2). In keeping with scope of the analysis, the pre-mining drainage areas were limited to the area from the southern confluence of the intermittent or ephemeral stream channels with Currant Creek or Tallahassee Creek to the northern boundary of proposed disturbance.

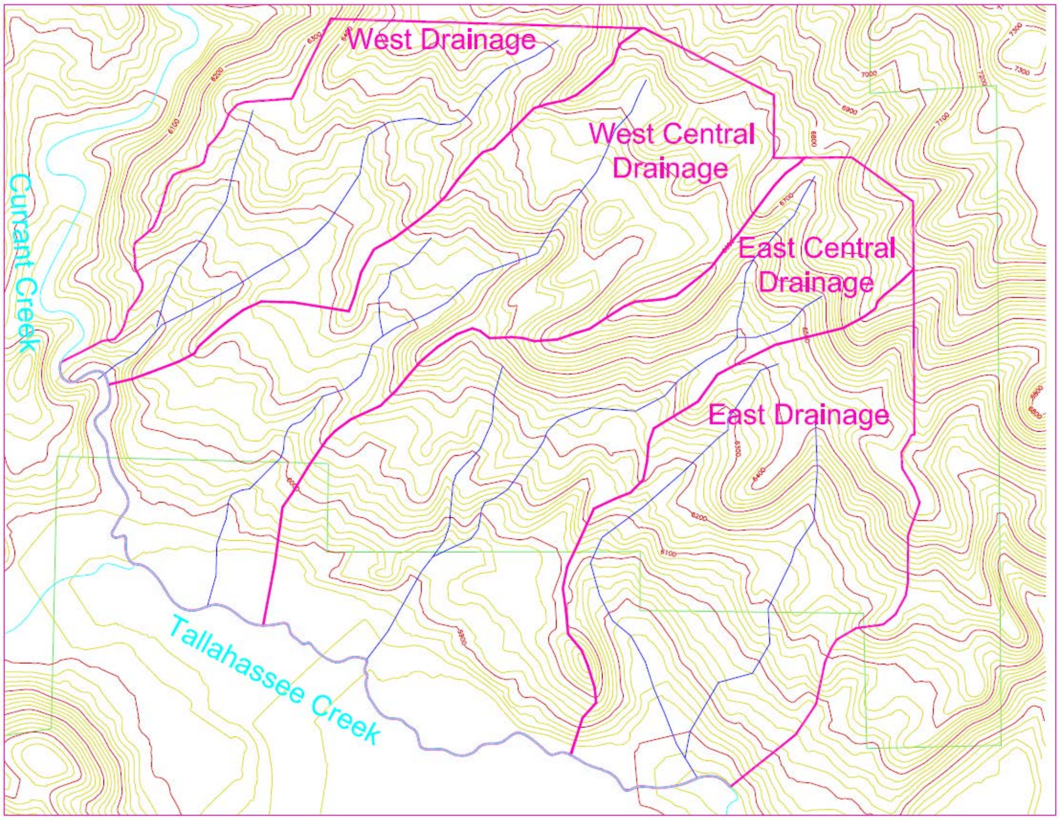


*Figure 2. Pre-Mining Watersheds Evaluated*

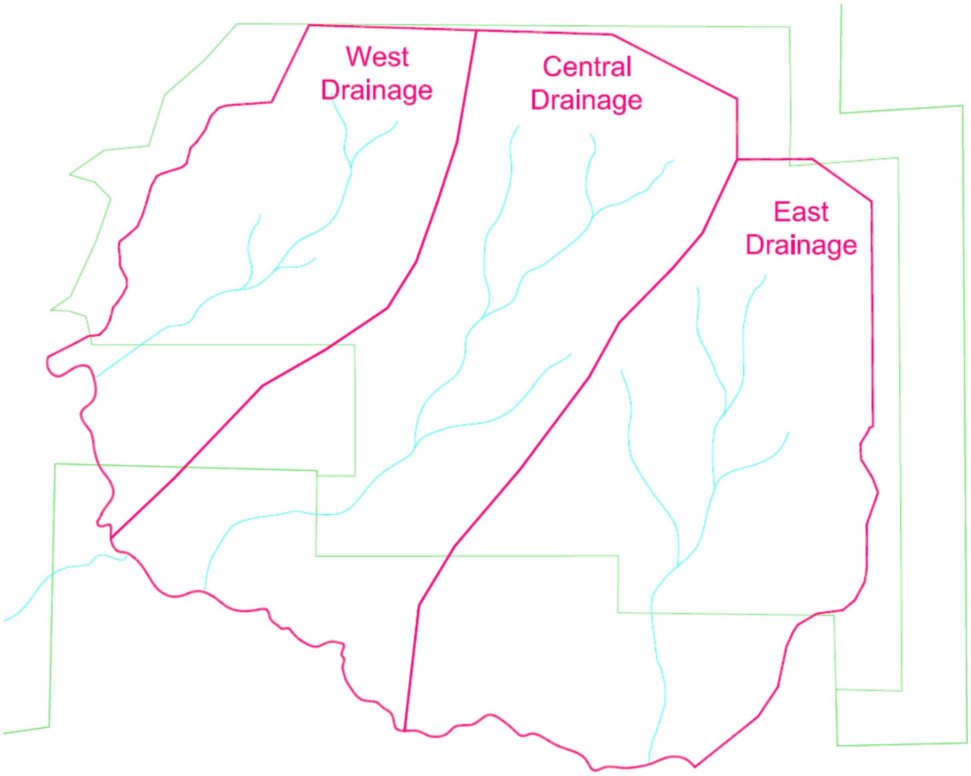


*Figure 3. Post-Mining Watersheds Evaluated*

## 2. RUNOFF MODELING

### 2.1 Runoff Estimation Methodology

Watershed runoff was estimated using the methods described in Technical Release 55 (TR-55), which was developed by the U. S. Department of Agriculture Natural Resources Conservation Service (NRCS, 1986). TR-55 presents simplified procedures to calculate storm runoff volume, peak rate of discharge, hydrographs, and storage volumes required for floodwater reservoirs in small watersheds.

Runoff depth ($q_d$) is calculated in TR-55 by the Curve Number (CN) method, using the following equation:

$$q_d = \frac{(P - 0.2S)^2}{(P + 0.8S)}$$

where: $q_d$ = Runoff depth, inches ($q_d = 0$, if $P < 0.2S$),
P = Rainfall depth, inches
S = Potential maximum rainfall retention after runoff begins, inches

This method assumes initial abstraction (losses before runoff begins due to retention in surface depressions, interception by vegetation, evaporation, infiltration etc.) is equal to 0.2S.

The parameter S is related to curve number (CN) by:

$$S = \frac{1000}{CN} - 10$$

Site-specific curve numbers are discussed in Section 1.3.

Runoff volume (Q) is obtained from : $Q = q_d / 12 \cdot A \cdot 43{,}560$

where: Q = Runoff volume, cubic feet
$q_d$ = Runoff depth, inches
A = Catchment area, acres

Peak discharge is calculated using Time of Concentration ($T_c$) which is the time it takes for runoff to travel from the most hydraulically distant point in the watershed (or sub-basin) to a point of interest. $T_c$ is the sum of travel time for sheet flow ($T_{sh}$) plus the travel time for shallow concentrated overland flow ($T_{sc}$) plus the travel time for channel flow ($T_{ch}$).

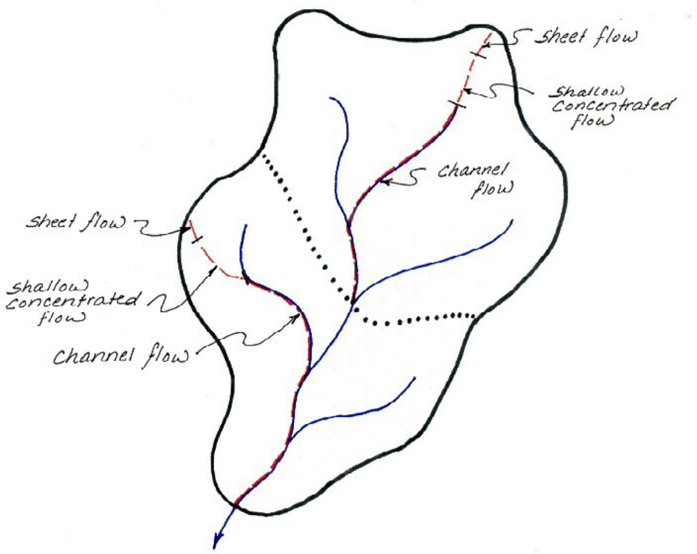


***Figure 4. Location of Sheet Flow, Shallow Concentrated Flow, and Channel Flow within a Basin***

Sheet flow occurs over plane surfaces in the "headwaters" or uppermost reaches of the watershed, as shown in Figure 4 above. For the pre-mining condition at the Parkdale Quarry Sales Area, sheet flow is assumed to occur in the upper 80 feet of the sub-basin. Sheet flow travel time is calculated using the simplified form of Manning's kinematic solution from Overton and Meadows (1976) which is Equation 3.3 of TR55 (NRCS, 1986):

$$T_{sh} = \frac{0.007\ (nL)^{0.8}}{P^{0.5} s^{0.4}}$$

where:

$T_{sh}$ = sheet flow travel time (hr)
n = Manning's roughness coefficient for surface flow
L = flow length (ft)
P = 24-hour rainfall (in)
s = land slope (ft/ft)

Shallow concentrated flow has been assumed to occur from the end of sheet flow until the flow path reaches an incised intermittent stream channel. The travel time for shallow concentrated flow is calculated as:

$$T_{sc} = \frac{L}{3600 \cdot V}$$

where:

$T_{sc}$ = shallow concentrated flow travel time (hr)
L = flow length (ft)
3600= conversion factor for seconds to hours
V = velocity on unpaved surface, interpolated from Figure 3-1 of TR-55 for land slope (ft/s) or calculated using Manning's equation:

$$V = \frac{1.49\, r^{2/3} s^{1/2}}{n}$$

where:

r = hydraulic radius = depth of flow = 0.4 ft
s = slope of the hydraulic grade line (land surface) (ft/ft)
n = Manning's n (roughness coefficient) for open channel flow = 0.05

Simplifying for unpaved conditions:

$V = 16.13\, s^{1/2}$

Channelized flow occurs in defined channels or intermittent drainages. The travel time for channelized flow is calculated using Manning's equation for channelized flow and the channel-specific geometry and hydraulic characteristics (rather than the simplifying assumptions used for shallow concentrated flow).

Shallow concentrated flow has been assumed to occur from the end of sheet flow until the flow path reaches a topographically well-defined channel. The travel time for shallow concentrated flow is calculated as:

$$T_{ch} = \frac{L}{3600 \cdot V}$$

where:

$T_{ch}$ = channel flow travel time (hr)
L = flow length (ft)

3600= conversion factor for seconds to hours
V = velocity (ft/sec) calculated using Manning's equation for channelized flow:

$$V = \frac{1.49\, r^{2/3} s^{1/2}}{n}$$

where:

r = hydraulic radius = cross sectional area / wetted perimeter (A/Pw) (ft)
s = slope of the hydraulic grade line (channel bottom) (ft/ft)
n = Manning's n (roughness coefficient) for open channel flow (as discussed in Section 2.3.2 and Table 5)

The $T_c$ values calculated using WinTR-55 and HydroCAD are provided in Section 2.3.3.

Runoff peak discharge is calculated from the TR-55 graphical peak discharge method. This approach graphically generates a unit peak discharge rate ($Q_u$) based upon the general catchment parameters of curve number (CN), initial abstraction ($I_a$), precipitation (P) and rainfall distribution type (type II for Colorado) and the individual catchment time of concentration ($T_c$). The input variables used in determining $Q_u$ using the graphical method were determined as follows:

CN = curve number based soil type, as discussed in Section 1.3 and Table 4
$I_a$ = initial abstraction, lookup value in Table 4-1 of TR-55 based on CN
P = Precipitation, based on design storms listed in Table 1 of this tech memo
$T_c$ = Time of concentration, calculated as discussed above

Peak discharge ($Q_p$) for the catchment area is then calculated from:

$$Q_p = Q_u \cdot A_m \cdot q \cdot F_p$$

where: $Q_p$ = Sub-basin peak discharge (cubic feet per second [cfs])
$Q_u$ = Sub-basin unit peak discharge (cfs/mi$^2$/in [csm/in])
$A_m$ = Sub-basin area (square miles)
q = Runoff (inches)
$F_p$ = Pond and swamp adjustment factor

## 2.2 Computational Methods

### *2.2.1 NRCS WinTR-55*

Peak discharge was computed using the NRCS WinTR-55 software (NRCS, 2009). WinTR-55 is a single-event rainfall-runoff, small watershed hydrologic model. The model generates hydrographs from urban, agricultural, and rural areas and at selected points along the stream system. Runoff hydrographs were generated by the model and routed downstream through channels. Multiple sub-areas were modeled within the watershed and routed to the applicable outfalls on Currant Creek and Tallahassee Creek. Although the computational methods employed in WinTR-55 are similar to the worksheet calculations in TR-55 (NRCS, 1986), WinTR-55 uses the TR-20 software engine for more accurate analysis of the hydrology of small watershed systems.

### *2.2.2 HydroCAD*

Peak discharge for sub-basins reporting to the Stormwater Retention Pond was also computed using the HydroCAD-10 software, distributed by HydroCAD Software Solutions, LLC. HydroCAD® uses the procedures described in TR-55 and TR-20 with added features for multiple pond routing, variable pond geometry, pond pumping, exfiltration, baseflow and inflow losses (that is, inflow to and exfiltration from reaches), and an increased number of "nodes" (reaches, sub-basin, and ponds) over the limited number available in WinTR-55. The runoff results computed by HydroCAD are essentially identical to those from the NRCS WinTR-55 software, but additional graphing capability, volumetric calculations, and reporting are available in HydroCAD.

## 2.3 Model Input

### *2.3.1 Watershed Delineation*

The model area was delineated into four catchments for the pre-mining simulation (Figure 2, Figure 5). These watersheds extended from the confluence with Currant Creek or Tallahassee Creek to the northern boundary of proposed disturbance, and totaled 1,040 acres. For the post-mining simulation, the total watershed area was kept constant with the pre-mining simulation (1,040 acres), but was subdivided into three catchments reflecting the proposed constructed stream channels in the mine reclamation plan (Figure 3, Figure 6).

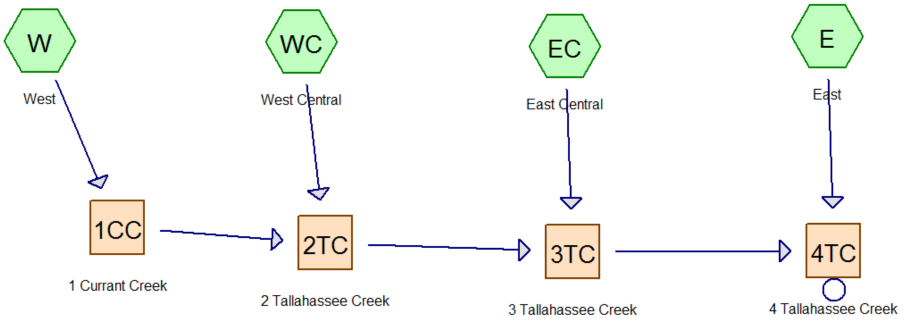


*Figure 5. HydroCAD Node Routing, Pre-Mining*

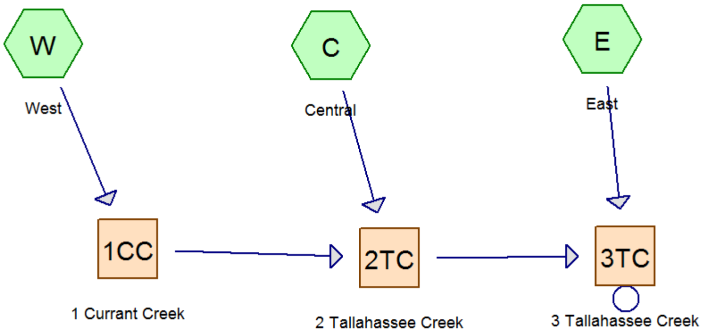


*Figure 6. HydroCAD Node Routing, Post-Mining*

### *2.3.2 Manning's n*

The value of Manning's n selected for each channel affects channel velocity, conveyance capacity, and peak flows. The most important factors that affect the selection of channel n values are:

1. Type and size of the materials that compose the bed and banks of the channel; and
2. Shape of the channel.

Cowan (1956) developed a procedure for estimating the effects of these factors to determine the value of n for a channel. The value of n may be computed by:

$$n = (n_b + n_1 + n_2 + n_3 + n_4) \cdot m$$

where :

$n_b$ = a base value of n for a straight, uniform, smooth channel in natural materials
$n_1$ = a correction factor for the effect of surface irregularities
$n_2$ = a value for variations in shape and size of the channel cross section,
$n_3$ = a value for obstructions
$n_4$ = a value for vegetation and flow conditions
$m$ = a correction factor for meandering of the channel

*Table 5. Manning's "n" Values Used in Cowan's Method for Channel Roughness*

| **Channel Condition** | **n Values** | Natural Channels | Borrow Ditches | Engineered Channels | Short Natural Channels |
|---|---|---|---|---|---|
| ***Material Involved*** | **$n_b$** | | | | |
| Earth | 0.02 | | | | 0.02 |
| Rock cut | 0.025 | 0.022 | 0.022 | 0.022 | |
| Fine gravel | 0.024 | | | | |
| Coarse gravel | 0.028 | | | | |
| ***Degree of Irregularity*** | **$n_1$** | | | | |
| Smooth | 0 | | | | |
| Minor | 0.005 | | | 0.005 | |
| Moderate | 0.01 | 0.01 | 0.01 | | 0.01 |
| Severe | 0.02 | | | | |
| ***Variations of Channel Cross Section*** | **$n_2$** | | | | |
| Gradual | 0 | | | | |
| Alternating occasionally | 0.005 | | 0.005 | 0.005 | 0.005 |
| Alternating frequently | 0.010-0.015 | 0.01 | | | |
| ***Relative Effect of Obstructions*** | **$n_3$** | | | | |
| Negligible | 0 | | | | |
| Minor | 0.010-0.015 | | 0.01 | 0.01 | 0.01 |
| Appreciable | 0.020-0.030 | 0.02 | | | |
| Severe | 0.040-0.060 | | | | |
| ***Vegetation*** | **$n_4$** | | | | |
| Low | 0.005-0.010 | 0.005 | 0.005 | 0.005 | 0.005 |
| Medium | 0.010-0.025 | | | | |
| High | 0.025-0.050 | | | | |
| Very high | 0.050-0.100 | | | | |
| ***Degree of Meandering*** | **m** | | | | |
| Minor | 1 | 1 | 1 | 1 | 1 |
| Appreciable | 1.15 | | | | |
| Severe | 1.3 | | | | |
| Calculated Manning's n value | | 0.067 | 0.052 | 0.047 | 0.05 |

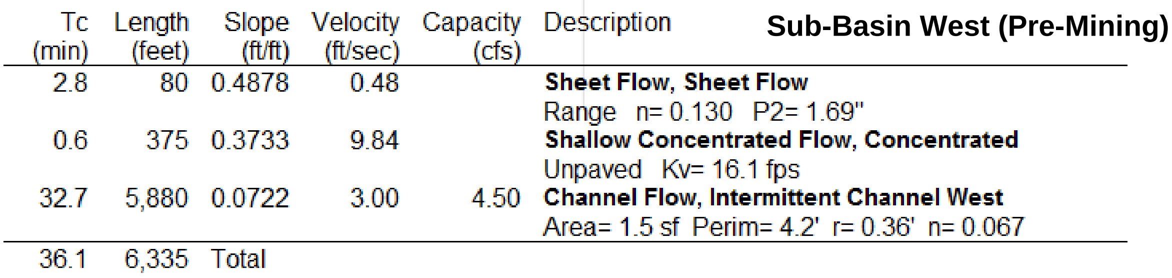
A Manning's n value of 0.067 was used for natural channels in the pre-mining simulation and for reconstructed channels in the post-mining simulation. These values affect the Time of Concentration (Section 2.3.3) and therefore the timing of peak flows, but do not affect the total volumetric runoff predicted by the model.

### *2.3.3 Time of Concentration*

As described in Section 2.1, Time of Concentration ($T_c$) is the time it takes for runoff to travel from the most hydraulically distant point in the watershed to the discharge outlet (or other point of interest). Tc values computed for the modeled basins are shown in Table 6 and Table 7.

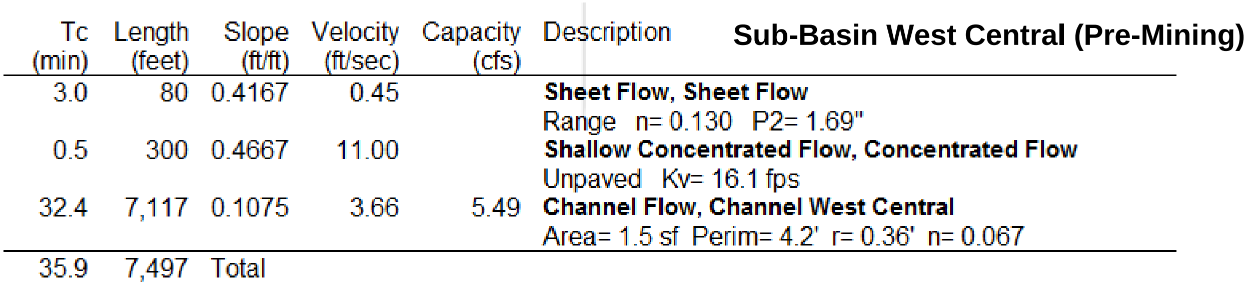
The area-weighted average Tc (Table 8) was 24% higher in the post-mining scenario, due the lower slopes and longer channel lengths in the reconstructed channels. The higher Tc helps to delay the arrival of peak flows from the watershed into the creek.

*Table 6. Watershed Channel Length, Slope, and Time of Concentration (Pre-Mining)*



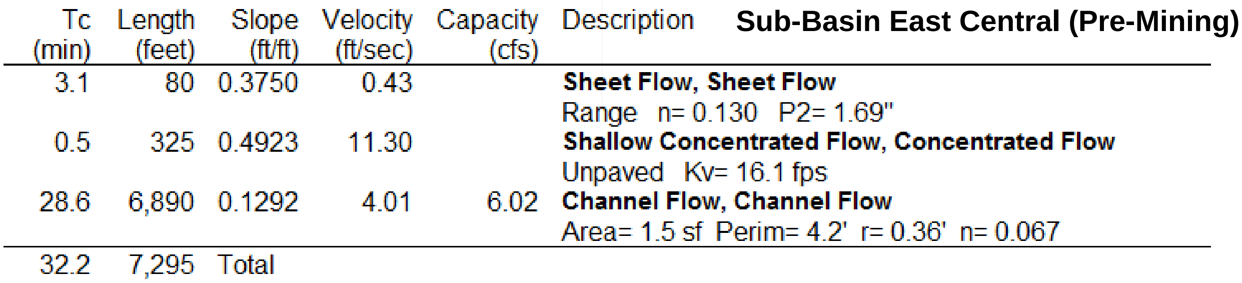
**Sub-Basin West (Pre-Mining)**

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 2.8 | 80 | 0.4878 | 0.48 | | **Sheet Flow, Sheet Flow**<br>Range n= 0.130 P2= 1.69" |
| 0.6 | 375 | 0.3733 | 9.84 | | **Shallow Concentrated Flow, Concentrated**<br>Unpaved Kv= 16.1 fps |
| 32.7 | 5,880 | 0.0722 | 3.00 | 4.50 | **Channel Flow, Intermittent Channel West**<br>Area= 1.5 sf Perim= 4.2' r= 0.36' n= 0.067 |
| 36.1 | 6,335 | Total | | | |



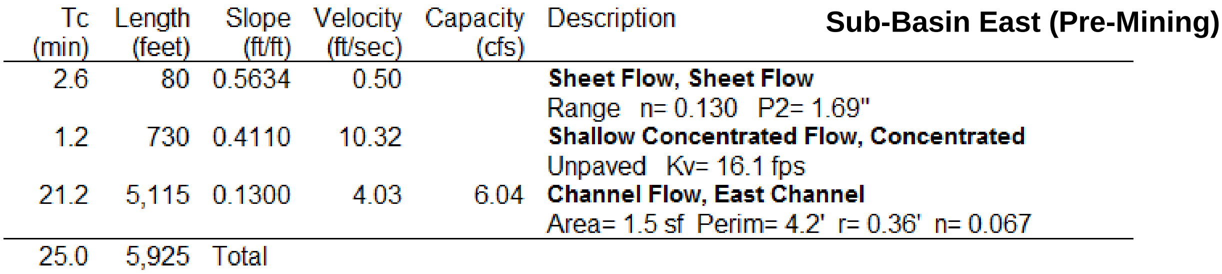
**Sub-Basin West Central (Pre-Mining)**

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 3.0 | 80 | 0.4167 | 0.45 | | **Sheet Flow, Sheet Flow**<br>Range n= 0.130 P2= 1.69" |
| 0.5 | 300 | 0.4667 | 11.00 | | **Shallow Concentrated Flow, Concentrated Flow**<br>Unpaved Kv= 16.1 fps |
| 32.4 | 7,117 | 0.1075 | 3.66 | 5.49 | **Channel Flow, Channel West Central**<br>Area= 1.5 sf Perim= 4.2' r= 0.36' n= 0.067 |
| 35.9 | 7,497 | Total | | | |



**Sub-Basin East Central (Pre-Mining)**

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 3.1 | 80 | 0.3750 | 0.43 | | **Sheet Flow, Sheet Flow**<br>Range n= 0.130 P2= 1.69" |
| 0.5 | 325 | 0.4923 | 11.30 | | **Shallow Concentrated Flow, Concentrated Flow**<br>Unpaved Kv= 16.1 fps |
| 28.6 | 6,890 | 0.1292 | 4.01 | 6.02 | **Channel Flow, Channel Flow**<br>Area= 1.5 sf Perim= 4.2' r= 0.36' n= 0.067 |
| 32.2 | 7,295 | Total | | | |



**Sub-Basin East (Pre-Mining)**

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 2.6 | 80 | 0.5634 | 0.50 | | **Sheet Flow, Sheet Flow**<br>Range n= 0.130 P2= 1.69" |
| 1.2 | 730 | 0.4110 | 10.32 | | **Shallow Concentrated Flow, Concentrated**<br>Unpaved Kv= 16.1 fps |
| 21.2 | 5,115 | 0.1300 | 4.03 | 6.04 | **Channel Flow, East Channel**<br>Area= 1.5 sf Perim= 4.2' r= 0.36' n= 0.067 |
| 25.0 | 5,925 | Total | | | |

### *Table 7. Watershed Channel Length, Slope, and Time of Concentration (Post-Mining)*

**Sub-Basin West (Post-Mining)**

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 0.2 | 40 | 0.5300 | 3.09 | | **Sheet Flow, Sheet Flow**<br>Smooth surfaces n= 0.011 P2= 1.69" |
| 0.9 | 650 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated**<br>Unpaved Kv= 16.1 fps |
| 13.5 | 3,560 | 0.0183 | 4.40 | 6.60 | **Channel Flow, Reclaimed Channel West**<br>Area= 1.5 sf Perim= 4.2' r= 0.36'<br>n= 0.023 Earth, clean & winding |
| 4.2 | 770 | 0.0779 | 3.07 | 4.60 | **Channel Flow, Outside pit channel**<br>Area= 1.5 sf Perim= 4.3' r= 0.35' n= 0.067 |
| 18.8 | 5,020 | Total | | | |

**Sub-Basin Central (Post-Mining)**

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 0.2 | 40 | 0.5300 | 3.09 | | **Sheet Flow, Sheet Flow**<br>Smooth surfaces n= 0.011 P2= 1.69" |
| 1.1 | 775 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated Flow**<br>Unpaved Kv= 16.1 fps |
| 61.0 | 5,310 | 0.0169 | 1.45 | 2.18 | **Channel Flow, Reclaimed channel Central**<br>Area= 1.5 sf Perim= 4.2' r= 0.36' n= 0.067 |
| 7.7 | 1,520 | 0.0888 | 3.28 | 4.91 | **Channel Flow, Channel outside pit Central**<br>Area= 1.5 sf Perim= 4.3' r= 0.35' n= 0.067 |
| 70.0 | 7,645 | Total | | | |

**Sub-Basin East (Post-Mining)**

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 1.6 | 40 | 0.5300 | 0.43 | | **Sheet Flow, Sheet Flow**<br>Range n= 0.130 P2= 1.69" |
| 1.0 | 708 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated**<br>Unpaved Kv= 16.1 fps |
| 14.0 | 3,820 | 0.0196 | 4.55 | 6.83 | **Channel Flow, Reclaimed Channel within Pit East**<br>Area= 1.5 sf Perim= 4.2' r= 0.36'<br>n= 0.023 Earth, clean & winding |
| 5.4 | 1,490 | 0.1711 | 4.62 | 6.93 | **Channel Flow, Channel outside pit - East**<br>Area= 1.5 sf Perim= 4.2' r= 0.36' n= 0.067 |
| 22.0 | 6,058 | Total | | | |

### *Table 8. Area-Weighted Average Time of Concentration*

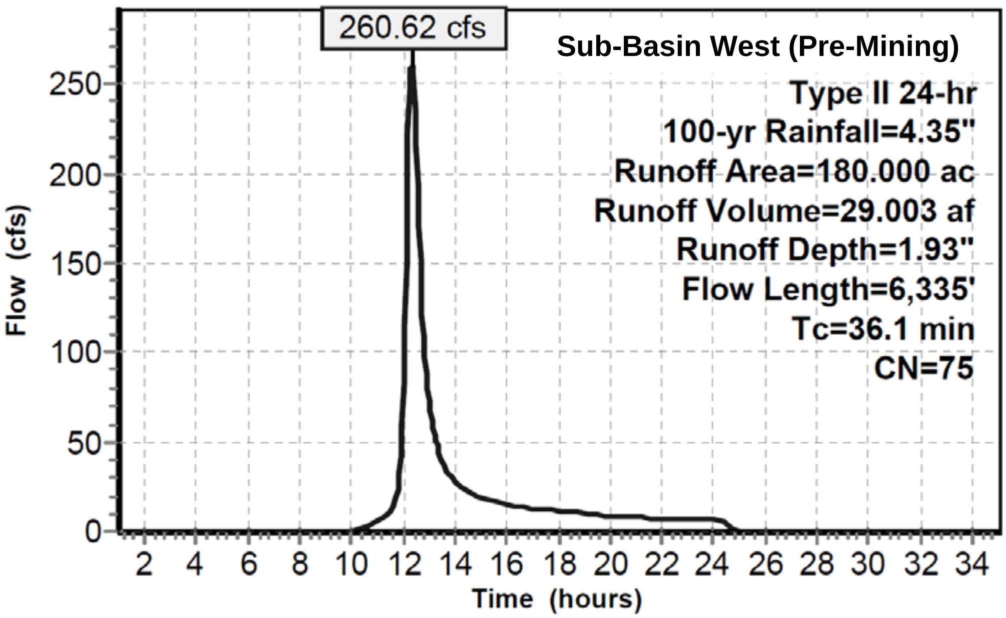
| Watershed Catchment | Phase | Tc (hydroCAD) (min) | SubBasin Area (acres) | Weighted Average Tc (min) |
|---|---|---|---|---|
| West | Pre-mining | 36.1 | 180 | |
| West Central | Pre-mining | 35.9 | 290 | |
| East Central | Pre-mining | 32.2 | 320 | |
| East | Pre-mining | 25.00 | 250 | 32.2 |
| West-Reclaimed | Post-mining | 18.8 | 235 | |
| Central-Reclaimed | Post-mining | 70.0 | 400 | |
| East-Reclaimed | Post-mining | 22.0 | 405 | 39.7 |

# 3. MODEL RESULTS

## 3.1 Results

Model results are provided in Attachment 3. Runoff hydrographs for the 100-year storm are shown in Figure 7 and Figure 8. The cumulative peak flows for the 100-year storm after reclamation (2,750 cfs) are 67% higher than before mining (1,650 cfs). Cumulative peak flows for the more frequent recurrence interval storms (2-yr, 5-yr, 10-yr, 25-yr, and 50-yr) are similarly higher in the post-mining model than in the pre-mining model. This implies that the mining project would result in higher flow rates in the intermittent drainages reporting to Currant Creek and Tallahassee Creek after major storm events.

The timing of peak flows is similar in the post-mining and pre-mining scenarios, with post-mining catchments West and East peaking earlier (12.10 – 12.15 hrs) than the pre-mining peaks (12.20 – 12.35 hrs) and the post-mining catchment Central peaking later (12.70 hrs). Runoff hydrographs for all storm events modeled are provided in Attachment 3.



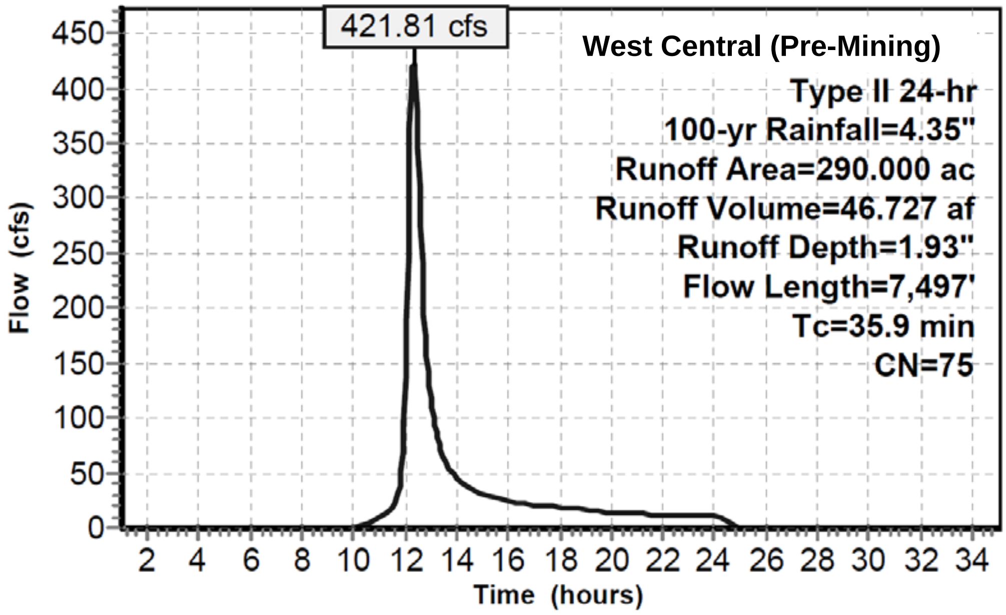
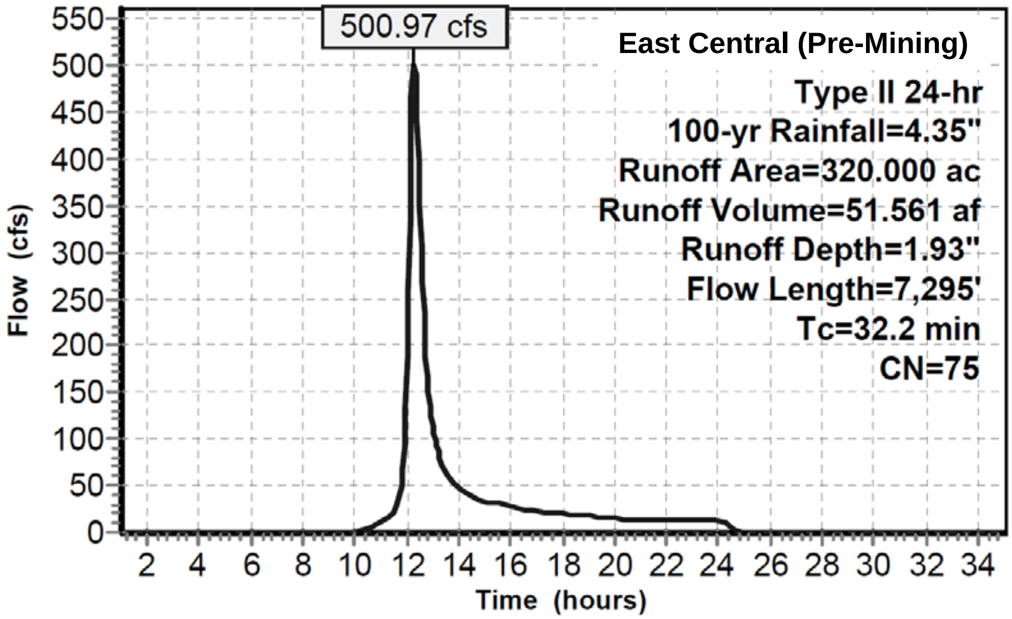


*Figure 7. Runoff Hydrographs for 100-Year Storm Event (Pre-Mining)*



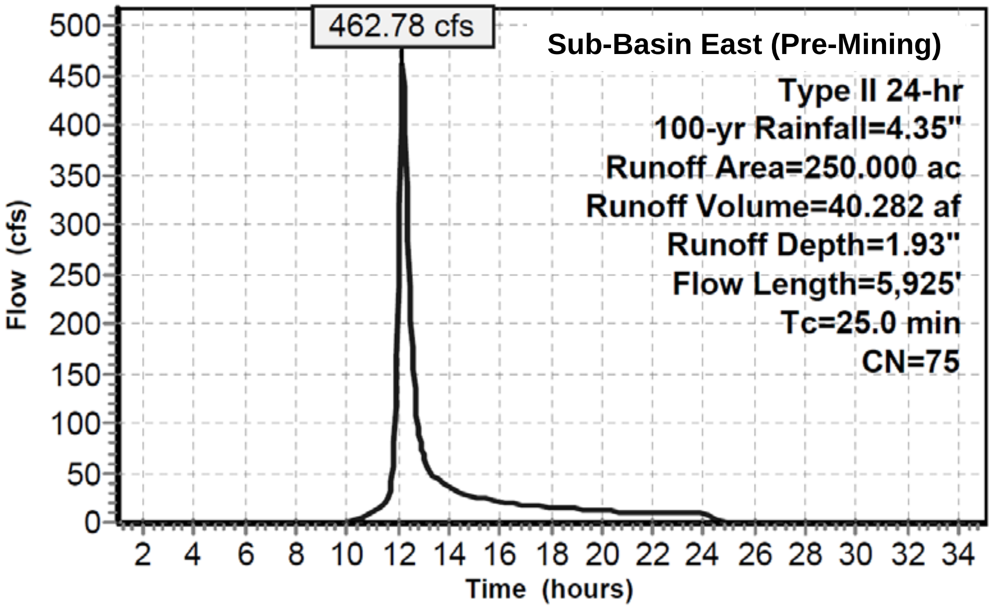


*Figure 7. Runoff Hydrographs for 100-Year Storm Event (Pre-Mining) (Part 2)*

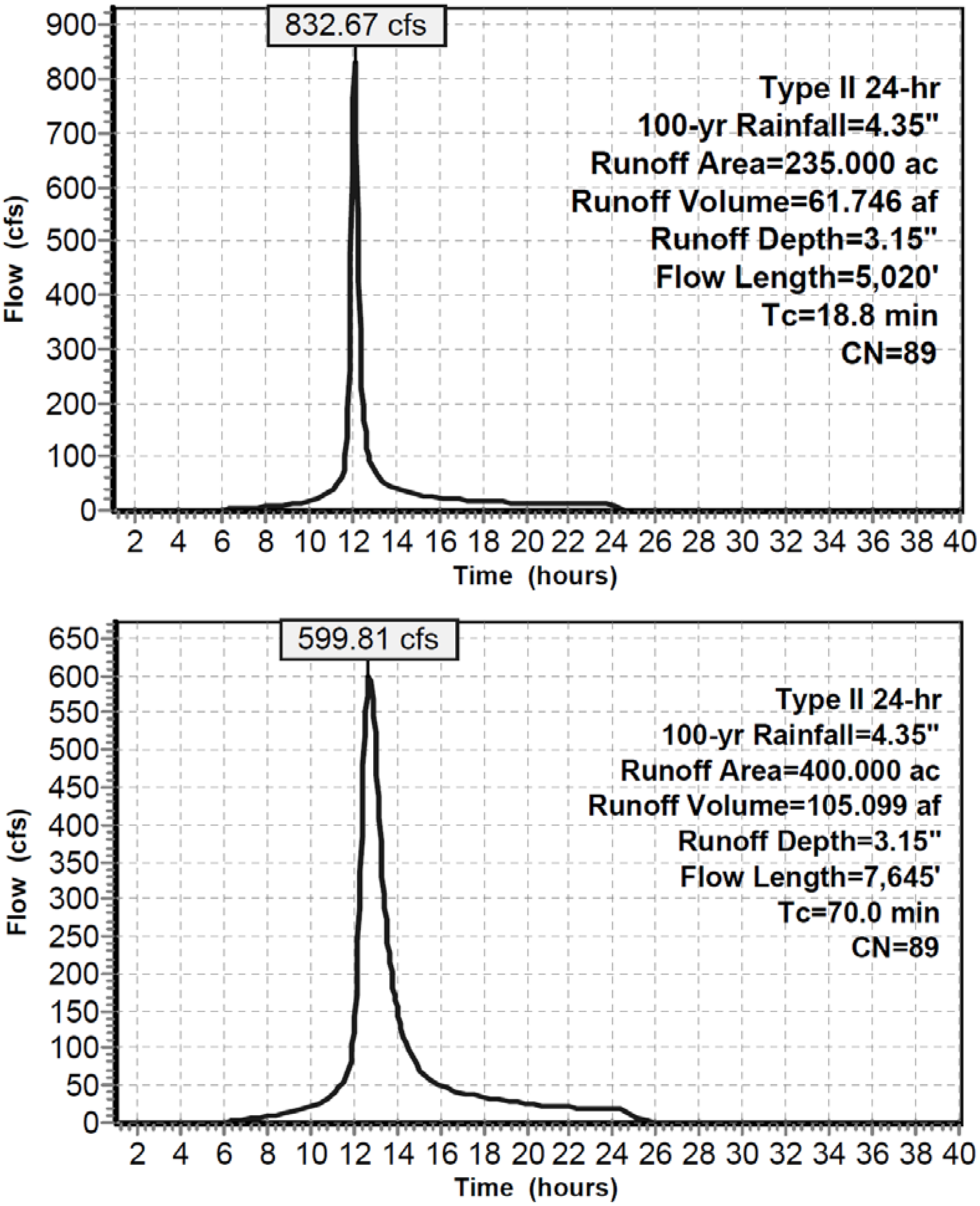


*Figure 8. Runoff Hydrographs for 100-Year Storm Event (Post-Mining)*

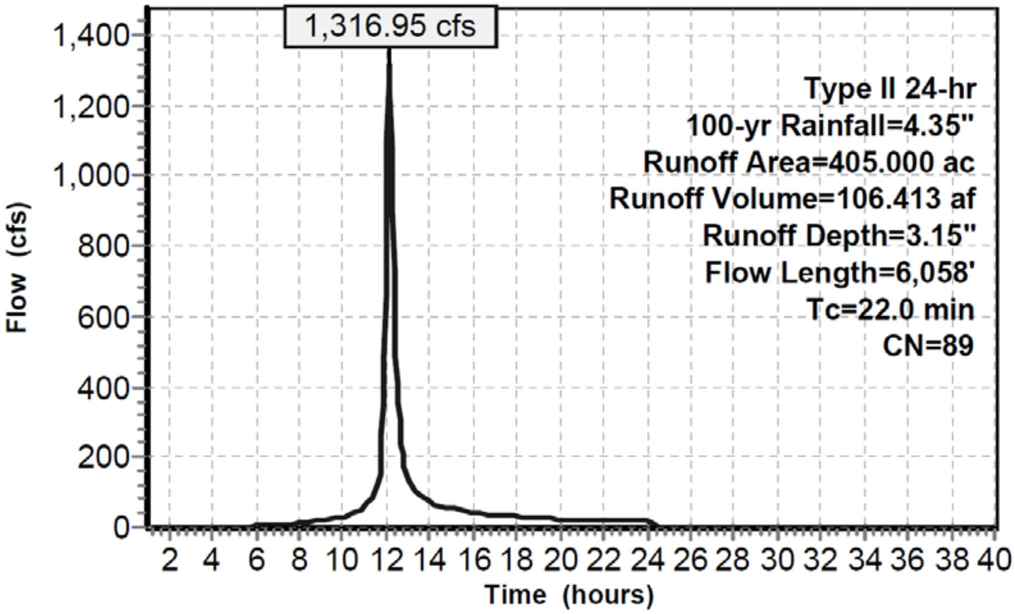


*Figure 8. Runoff Hydrographs for 100-Year Storm Event (Post-Mining) (Part 2)*

The total volume of runoff from major storms would increase as a result of mining and reclamation. The model results (Attachment 3) indicates that the volume of runoff reporting to the creeks would increase by 160% for the 100-year precipitation event and by 220% for the 10-year precipitation event (Table 9). The increased runoff is primarily due to the change in vegetation after reclamation.

Increased runoff could consequently decrease evapotranspiration and infiltration of precipitation and snowmelt to groundwater. Decreased infiltration to groundwater is expected to result in decreased baseflows to the creeks, which would be partially offset by increased streamflows during major storm events.

*Table 9. Relative Comparison Pre-Mining and Post-Mining Runoff Volumes*

| Watershed Drainage | Phase | Runoff Volume (acre-ft) P2yr-24hr | Runoff Volume (acre-ft) P5yr-24hr | Runoff Volume (acre-ft) P10yr-24hr | Runoff Volume (acre-ft) P25yr-24hr | Runoff Volume (acre-ft) P50yr-24hr | Runoff Volume (acre-ft) P100yr-24hr |
|---|---|---|---|---|---|---|---|
| West | Pre-mining | 3.6 | 6.6 | 9.9 | 16.1 | 22.0 | 29.0 |
| West Central | Pre-mining | 5.8 | 10.7 | 16.0 | 25.9 | 35.5 | 46.7 |
| East Central | Pre-mining | 6.4 | 11.8 | 17.7 | 28.6 | 39.1 | 51.6 |
| East | Pre-mining | 5.0 | 9.2 | 13.8 | 22.4 | 30.6 | 40.3 |
| West-Reclaimed | Post-mining | 15.2 | 22.1 | 28.8 | 40.2 | 50.3 | 61.7 |
| Central-Reclaimed | Post-mining | 25.9 | 37.6 | 49.1 | 68.5 | 85.7 | 105.1 |
| East-Reclaimed | Post-mining | 26.2 | 38.1 | 49.7 | 69.3 | 86.8 | 106.4 |
| Total Pre | Pre-mining | 20.8 | 38.2 | 57.4 | 93.1 | 127.1 | 167.6 |
| Total Post | Post-mining | 67.4 | 97.8 | 127.6 | 178.0 | 222.8 | 273.3 |
| Increase (multiplier) | | 3.2 | 2.6 | 2.2 | 1.9 | 1.8 | 1.6 |

The long-term average annual change in runoff volumes was calculated using the probability of occurrence for each design storm in a given year. The probability-weighted average annual runoff volume for the pre-mining condition is 31.7 acre-ft compared to 80.3 acre-ft for the post-mining condition. The annualized increase in runoff in Tallahassee Creek below the Sale Area, calculated from the probability-weighted changes in runoff for the 2-yr, 5-yr, 10-yr, 25-yr, 50-yr, and 100-yr storms, is 0.067 cfs

***Table 10. Relative Comparison of Pre-Mining and Post-Mining Annualized Average Runoff Volumes***

| Watershed Drainage | Phase | Annualized Runoff (acre-ft/yr) | Outlet | % Change |
|---|---|---|---|---|
| West | Pre-mining | 5.5 | Currant Creek | |
| West Central | Pre-mining | 8.9 | Tallahassee Ck | |
| East Central | Pre-mining | 9.8 | Tallahassee Ck | |
| East | Pre-mining | 7.6 | Tallahassee Ck | |
| West-Reclaimed | Post-mining | 18.1 | Currant Creek | 330% |
| Central-Reclaimed | Post-mining | 30.9 | Tallahassee Ck | |
| East-Reclaimed | Post-mining | 31.3 | Tallahassee Ck | 237% |
| Total Pre | Pre-mining | 31.7 | | |
| Total Post | Post-mining | 80.3 | Total | 253% |

## 3.2 Comparison to Tallahassee Creek-Currant Creek Watershed Runoff

The runoff results for the Sale Area were compared to the runoff from the regional watershed to determine the magnitude of change as a percentage of regional flows. The portion of the Sale Area modeled is 1,040 acres, or approximately 1.37% of the 108.3 square miles in the Tallahassee Creek-Currant Creek watershed (HUC 1102000111) (Table 11).

***Table 11. Hydrologic Units in the Arkansas River Headwaters***

| 4th Level Sub-Basin (HUC 8) | 5th Level Watershed (HUC 10) | 6th Level Sub-Watershed (HUC 12) | Sq. Mile |
|---|---|---|---|
| **Arkansas Headwaters (11020001)** | **Tallahassee Creek-Currant Creek (1102000111)** | Lower Cottonwood Creek (110200011108) | 32.8 |
| | | Lower Currant Creek (110200011109) | 35.3 |
| | | Tallahassee Creek (110200011110) | 50.2 |
| | **Royal Gorge-Arkansas River (1102000114)** | Five Point Gulch-Arkansas River (110200011407) | 47.4 |
| | | Royal Gorge (110200011409) | 26.0 |

### 3.3 Model Sensitivity

The runoff volumes predicted by the model are most sensitive to precipitation and runoff curve numbers. The curve numbers used in the model are the best engineering estimates of pre-mining and reclaimed conditions. If mine reclamation were to more nearly mimic the pre-mining condition, with respect to soils and vegetation, the post-mining runoff would more nearly resemble the pre-mining conditions.

## 4. REFERENCES

BLM 2017. Environmental Assessment, Parkdale Area Mineral Materials Sampling, U.S. Bureau of Land Management Royal Gorge Field Office, DOI-BLM-CO-F020-2016-0083 EA, December, 2017

Cowan, W.L., 1956. Estimating hydraulic roughness coefficients, Agricultural Engineering, v. 37, no. 7, pp. 473-475.

ERM 2019. Interim Hydrogeologic Assessment, Parkdale Quarry Expansion Area, prepared by Environmental Resources Management (ERM) for Martin Marietta Materials, Project No. 0488586, August 20, 2019.

NOAA 2020. NOAA Atlas 14, Volume 8, Version 2, Point Precipitation Frequency Estimates, by Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin, NOAA, National Weather Service, Silver Spring, Maryland, downloaded 1/9/2020. https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_printpage.html?lat=38.4995&lon=-105.3943&data=depth&units=english&series=pds

NRCS (SCS), 1965. TR20: Computer Program for Project Formulation - Hydrology, May 1965, 167 pp.

NRCS (SCS), 1983. TR20: Computer Program for Project Formulation - Hydrology, revised 1983, 294 pp.

NRCS (SCS), 1986. Urban Hydrology for Small Watersheds - TR-55, United States Department of Agriculture, Natural Resources Conservation Service, Technical Release 55, June 1986.

NRCS 2007. National Engineering Handbook Part 630 Hydrology, Chapter 7 Hydrologic Soil Groups. 210–VI–NEH, May 2007.

NRCS (SCS), 2009. WinTR20 Version 1.11: Computer Program for Project Formulation - Hydrology, Updated March 2009. Available for download from http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/?&cid=stelprdb1042793

NRCS, 2009. Small Watershed Hydrology, WinTR–55 User Guide, United States Department of Agriculture, Natural Resources Conservation Service, January 2009.

Overton, D.E. and Meadows, M.E., 1976. Stormwater Modeling, Published by Academic Press, Orlando Florida.

USDC, 1973. NOAA Atlas 2, Precipitation-Frequency Atlas of the Western United States, Volume III-Colorado, National Oceanic And Atmospheric Administration, U. S. Department of Commerce.

## 5. LIST OF ATTACHMENTS

Attachment 1. Precipitation Frequency Data
Attachment 2. Soil Map and Descriptions
Attachment 3. HydroCAD Model Reports

## *Attachment 1. Precipitation Frequency Data*

NOAA 14 Atlas 14, Volume 8, Version 2

POINT PRECIPITATION FREQUENCY ESTIMATES

**NOAA Atlas 14, Volume 8, Version 2**
**Location name: Canon City, Colorado, USA***
**Latitude: 38.4995°, Longitude: -105.3943°**
**Elevation: 6160.63 ft****
* source: ESRI Maps
** source: USGS

## POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

## PF tabular

### PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

| Duration | Average recurrence interval (years) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 | 1000 |
| 5-min | **0.225**<br>(0.174-0.292) | **0.265**<br>(0.205-0.345) | **0.344**<br>(0.266-0.450) | **0.422**<br>(0.324-0.554) | **0.546**<br>(0.414-0.770) | **0.655**<br>(0.482-0.934) | **0.777**<br>(0.552-1.14) | **0.913**<br>(0.622-1.38) | **1.11**<br>(0.728-1.73) | **1.28**<br>(0.808-2.00) |
| 10-min | **0.329**<br>(0.255-0.428) | **0.388**<br>(0.301-0.506) | **0.504**<br>(0.389-0.659) | **0.617**<br>(0.474-0.811) | **0.799**<br>(0.606-1.13) | **0.960**<br>(0.705-1.37) | **1.14**<br>(0.808-1.67) | **1.34**<br>(0.910-2.02) | **1.63**<br>(1.07-2.54) | **1.87**<br>(1.18-2.93) |
| 15-min | **0.401**<br>(0.311-0.522) | **0.474**<br>(0.367-0.617) | **0.615**<br>(0.474-0.803) | **0.753**<br>(0.578-0.989) | **0.975**<br>(0.739-1.38) | **1.17**<br>(0.860-1.67) | **1.39**<br>(0.985-2.03) | **1.63**<br>(1.11-2.46) | **1.99**<br>(1.30-3.09) | **2.28**<br>(1.44-3.57) |
| 30-min | **0.557**<br>(0.431-0.724) | **0.657**<br>(0.508-0.855) | **0.852**<br>(0.657-1.11) | **1.04**<br>(0.800-1.37) | **1.35**<br>(1.02-1.90) | **1.62**<br>(1.19-2.31) | **1.92**<br>(1.36-2.81) | **2.25**<br>(1.54-3.41) | **2.74**<br>(1.80-4.27) | **3.15**<br>(1.99-4.93) |
| 60-min | **0.700**<br>(0.542-0.910) | **0.813**<br>(0.629-1.06) | **1.04**<br>(0.805-1.36) | **1.28**<br>(0.980-1.68) | **1.66**<br>(1.27-2.36) | **2.01**<br>(1.48-2.88) | **2.40**<br>(1.71-3.54) | **2.85**<br>(1.94-4.32) | **3.50**<br>(2.30-5.47) | **4.05**<br>(2.56-6.34) |
| 2-hr | **0.843**<br>(0.660-1.08) | **0.969**<br>(0.758-1.25) | **1.24**<br>(0.963-1.60) | **1.51**<br>(1.17-1.96) | **1.98**<br>(1.53-2.79) | **2.41**<br>(1.80-3.41) | **2.89**<br>(2.08-4.21) | **3.44**<br>(2.38-5.16) | **4.26**<br>(2.83-6.58) | **4.95**<br>(3.17-7.65) |
| 3-hr | **0.923**<br>(0.728-1.18) | **1.05**<br>(0.824-1.34) | **1.32**<br>(1.04-1.70) | **1.62**<br>(1.26-2.08) | **2.12**<br>(1.65-2.98) | **2.59**<br>(1.95-3.66) | **3.13**<br>(2.27-4.53) | **3.74**<br>(2.60-5.58) | **4.66**<br>(3.11-7.16) | **5.44**<br>(3.50-8.35) |
| 6-hr | **1.08**<br>(0.859-1.36) | **1.21**<br>(0.964-1.53) | **1.51**<br>(1.20-1.91) | **1.83**<br>(1.44-2.33) | **2.39**<br>(1.88-3.31) | **2.91**<br>(2.21-4.05) | **3.50**<br>(2.57-5.01) | **4.19**<br>(2.95-6.17) | **5.22**<br>(3.52-7.91) | **6.09**<br>(3.96-9.22) |
| 12-hr | **1.27**<br>(1.02-1.58) | **1.43**<br>(1.15-1.79) | **1.78**<br>(1.42-2.22) | **2.13**<br>(1.70-2.68) | **2.72**<br>(2.16-3.70) | **3.26**<br>(2.50-4.47) | **3.87**<br>(2.86-5.45) | **4.57**<br>(3.24-6.61) | **5.60**<br>(3.81-8.34) | **6.46**<br>(4.24-9.65) |
| 24-hr | **1.47**<br>(1.20-1.81) | **1.69**<br>(1.38-2.09) | **2.12**<br>(1.72-2.62) | **2.52**<br>(2.04-3.14) | **3.17**<br>(2.51-4.20) | **3.73**<br>(2.87-5.00) | **4.35**<br>(3.24-5.99) | **5.03**<br>(3.59-7.15) | **6.03**<br>(4.14-8.83) | **6.85**<br>(4.55-10.1) |
| 2-day | **1.68**<br>(1.38-2.05) | **1.98**<br>(1.63-2.41) | **2.51**<br>(2.06-3.06) | **2.99**<br>(2.44-3.67) | **3.73**<br>(2.97-4.84) | **4.35**<br>(3.37-5.72) | **5.01**<br>(3.76-6.78) | **5.74**<br>(4.13-8.01) | **6.77**<br>(4.68-9.74) | **7.60**<br>(5.10-11.1) |
| 3-day | **1.85**<br>(1.53-2.23) | **2.17**<br>(1.80-2.63) | **2.75**<br>(2.27-3.34) | **3.28**<br>(2.70-4.00) | **4.08**<br>(3.27-5.25) | **4.75**<br>(3.71-6.20) | **5.47**<br>(4.13-7.34) | **6.25**<br>(4.53-8.65) | **7.36**<br>(5.12-10.5) | **8.26**<br>(5.58-11.9) |
| 4-day | **2.00**<br>(1.67-2.41) | **2.35**<br>(1.95-2.82) | **2.96**<br>(2.46-3.57) | **3.52**<br>(2.90-4.27) | **4.36**<br>(3.52-5.59) | **5.08**<br>(3.98-6.58) | **5.84**<br>(4.43-7.79) | **6.66**<br>(4.85-9.17) | **7.83**<br>(5.48-11.1) | **8.78**<br>(5.96-12.6) |
| 7-day | **2.40**<br>(2.02-2.86) | **2.80**<br>(2.35-3.33) | **3.49**<br>(2.93-4.17) | **4.12**<br>(3.43-4.95) | **5.06**<br>(4.11-6.39) | **5.84**<br>(4.63-7.49) | **6.68**<br>(5.11-8.80) | **7.58**<br>(5.56-10.3) | **8.84**<br>(6.24-12.4) | **9.86**<br>(6.75-14.0) |
| 10-day | **2.75**<br>(2.33-3.25) | **3.19**<br>(2.69-3.77) | **3.95**<br>(3.33-4.69) | **4.63**<br>(3.88-5.52) | **5.63**<br>(4.59-7.04) | **6.45**<br>(5.13-8.19) | **7.32**<br>(5.62-9.56) | **8.25**<br>(6.08-11.1) | **9.55**<br>(6.77-13.3) | **10.6**<br>(7.29-14.9) |
| 20-day | **3.71**<br>(3.18-4.33) | **4.26**<br>(3.65-4.98) | **5.19**<br>(4.42-6.08) | **5.98**<br>(5.07-7.05) | **7.11**<br>(5.84-8.72) | **8.01**<br>(6.43-9.98) | **8.93**<br>(6.93-11.4) | **9.90**<br>(7.36-13.1) | **11.2**<br>(8.01-15.3) | **12.2**<br>(8.51-17.0) |
| 30-day | **4.48**<br>(3.87-5.19) | **5.14**<br>(4.43-5.96) | **6.22**<br>(5.34-7.23) | **7.11**<br>(6.07-8.32) | **8.35**<br>(6.89-10.1) | **9.31**<br>(7.50-11.5) | **10.3**<br>(8.00-13.0) | **11.2**<br>(8.40-14.7) | **12.5**<br>(9.00-16.9) | **13.5**<br>(9.46-18.6) |
| 45-day | **5.45**<br>(4.73-6.27) | **6.25**<br>(5.43-7.20) | **7.54**<br>(6.52-8.71) | **8.58**<br>(7.37-9.96) | **9.97**<br>(8.25-11.9) | **11.0**<br>(8.91-13.4) | **12.0**<br>(9.40-15.0) | **13.0**<br>(9.76-16.8) | **14.3**<br>(10.3-19.0) | **15.2**<br>(10.7-20.7) |
| 60-day | **6.27**<br>(5.47-7.17) | **7.21**<br>(6.28-8.25) | **8.69**<br>(7.55-9.97) | **9.86**<br>(8.52-11.4) | **11.4**<br>(9.45-13.5) | **12.5**<br>(10.2-15.1) | **13.6**<br>(10.7-16.8) | **14.6**<br>(11.0-18.7) | **15.8**<br>(11.5-21.0) | **16.7**<br>(11.8-22.7) |

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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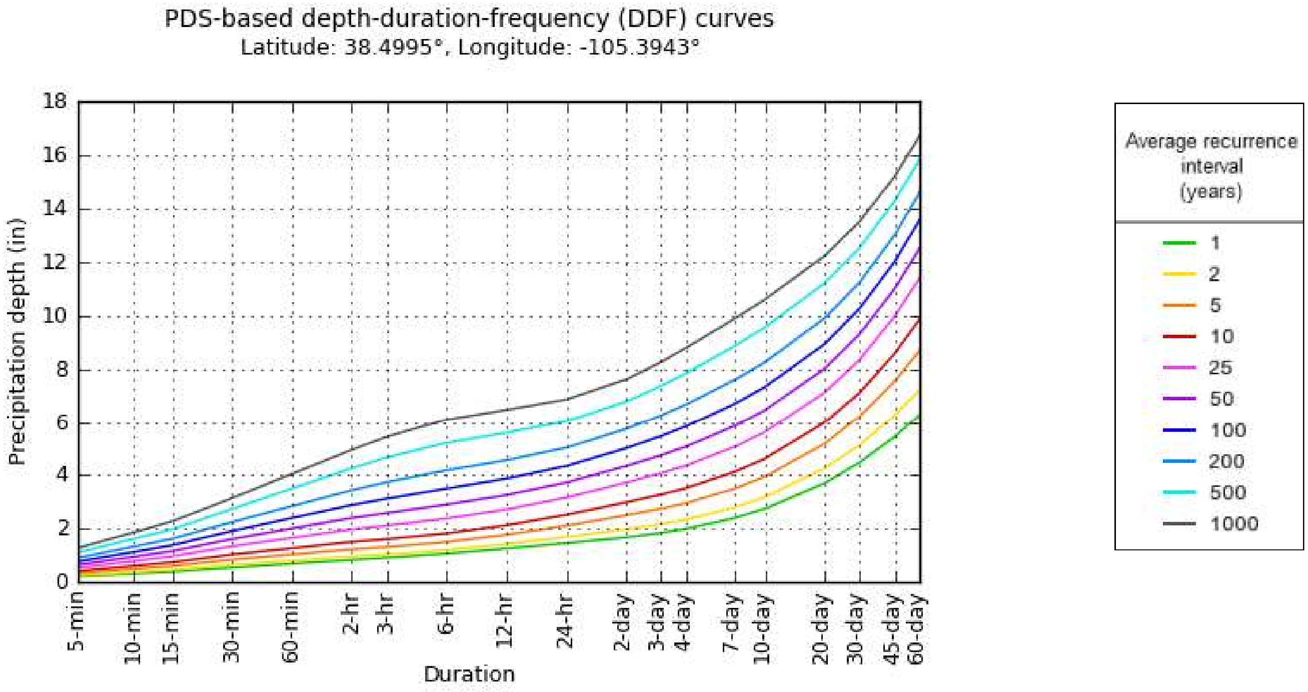
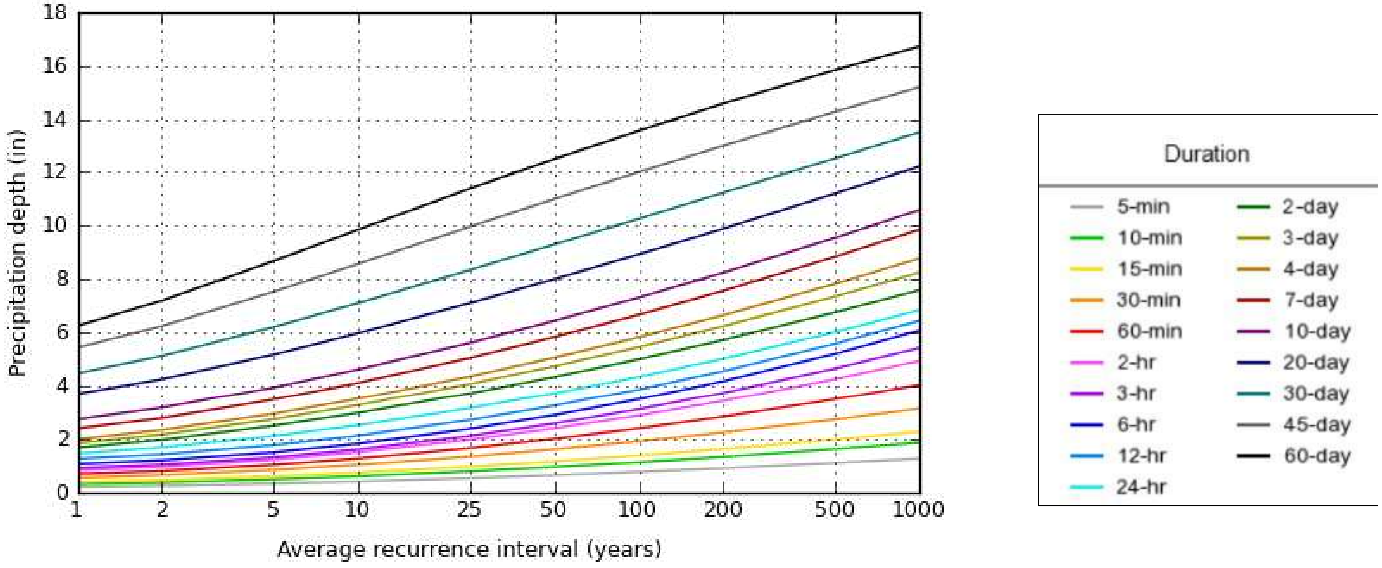
## PF graphical





NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Thu Jan 9 21:35:08 2020

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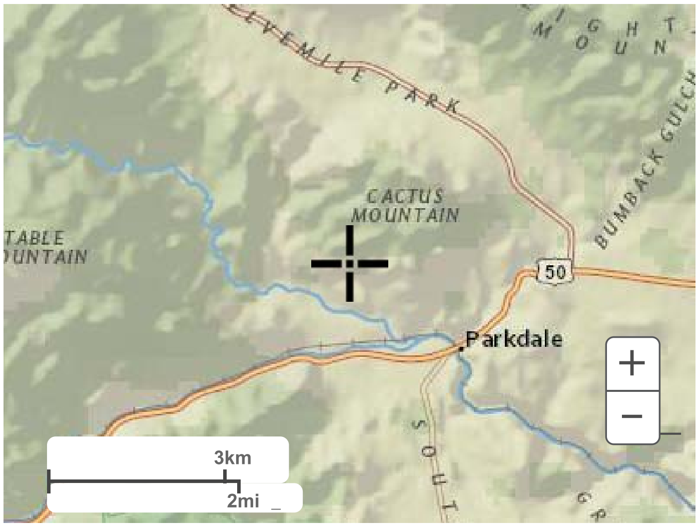
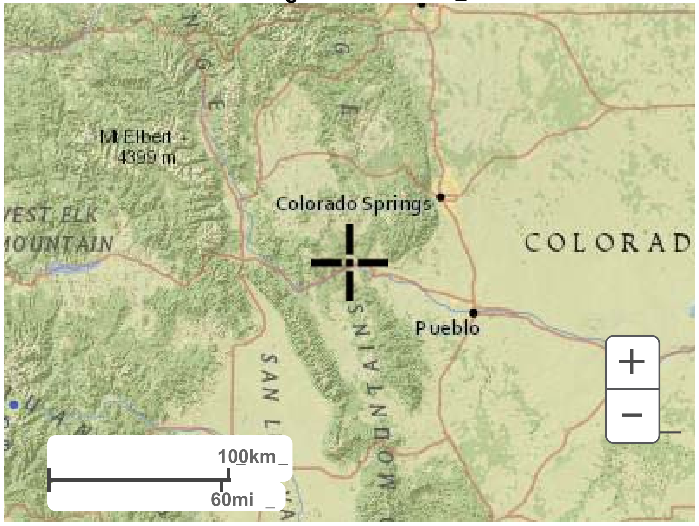
## Maps & aerials

### Small scale terrain

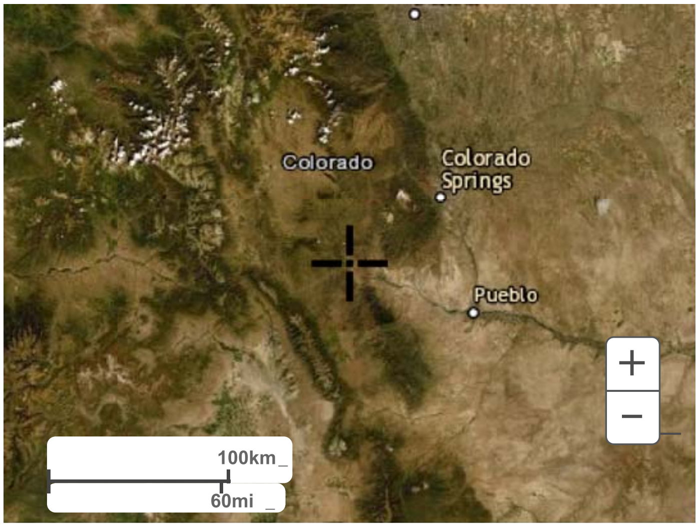


Large scale terrain



Large scale map

Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

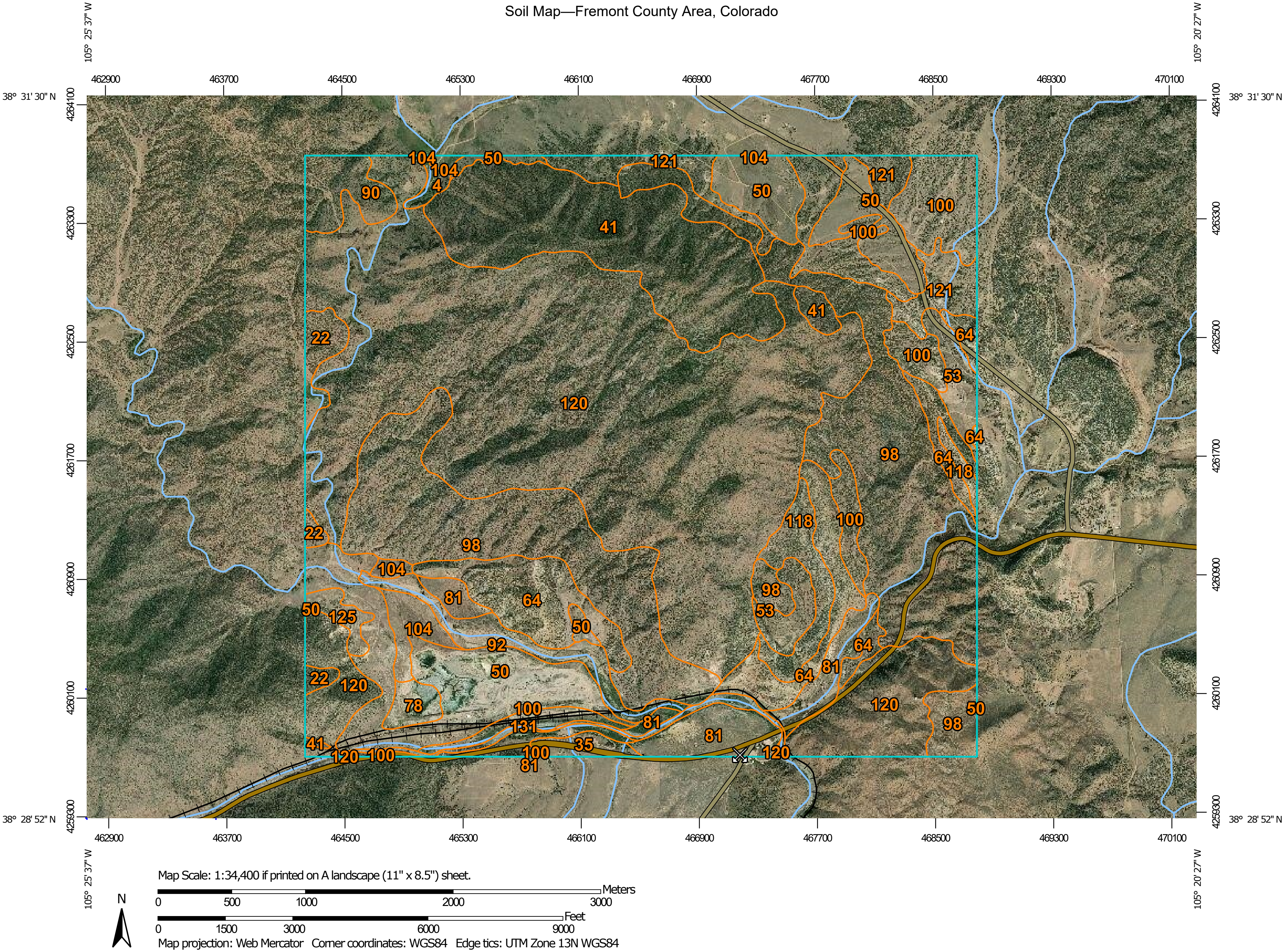
Disclaimer

## *Attachment 2. Soil Map and Descriptions*

NRCS Web Soil Survey

Fremont County, Colorado Area

# Soil Map—Fremont County Area, Colorado



Map Scale: 1:34,400 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

## MAP LEGEND

**Area of Interest (AOI)**
- ▭ Area of Interest (AOI)

**Soils**
- ▭ Soil Map Unit Polygons
- 〰 Soil Map Unit Lines
- ■ Soil Map Unit Points

**Special Point Features**
- ◎ Blowout
- ⊠ Borrow Pit
- ✱ Clay Spot
- ◇ Closed Depression
- ✕ Gravel Pit
- ∴ Gravelly Spot
- ● Landfill
- Λ Lava Flow
- ⏚ Marsh or swamp
- ⚒ Mine or Quarry
- ◎ Miscellaneous Water
- ○ Perennial Water
- ∨ Rock Outcrop
- + Saline Spot
- ⁘ Sandy Spot
- ⊖ Severely Eroded Spot
- ◇ Sinkhole
- ⟫ Slide or Slip
- ∅ Sodic Spot
- ≡ Spoil Area
- ◊ Stony Spot
- ◊◊ Very Stony Spot
- ψ Wet Spot
- △ Other
- ‐ ‐ Special Line Features

**Water Features**
- 〜 Streams and Canals

**Transportation**
- ┼┼┼ Rails
- 〰 Interstate Highways
- 〰 US Routes
- 〰 Major Roads
- 〰 Local Roads

**Background**
- ▨ Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Fremont County Area, Colorado
Survey Area Data: Version 17, Sep 13, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Nov 19, 2013—Nov 15, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| 4 | Aquolls, 0 to 5 percent slopes | 11.2 | 0.2% |
| 22 | Coaldale very gravelly sandy loam, 20 to 45 percent slopes | 45.5 | 1.0% |
| 35 | Fort Collins loam, cool, 0 to 2 percent slopes | 21.7 | 0.5% |
| 41 | Haploborolls, very stony-Rock outcrop complex, 40 to 90 percent slopes | 391.3 | 8.6% |
| 50 | Kim loam, cool, 3 to 8 percent slopes | 377.8 | 8.3% |
| 53 | Kim-Shingle complex, 3 to 20 percent slopes | 74.1 | 1.6% |
| 64 | Louviers-Travessilla complex, 20 to 50 percent slopes | 252.2 | 5.5% |
| 78 | Nunn clay loam, 0 to 3 percent slopes, dry | 23.6 | 0.5% |
| 81 | Otero fine sandy loam, 3 to 8 percent slopes | 132.2 | 2.9% |
| 90 | Resort very gravelly sandy loam, 20 to 45 percent slopes | 57.6 | 1.3% |
| 92 | Riverwash | 71.9 | 1.6% |
| 98 | Roygorge very gravelly sandy clay loam, 25 to 50 percent slopes | 849.9 | 18.6% |
| 100 | Sedillo cobbly sandy loam, 4 to 25 percent slopes | 269.1 | 5.9% |
| 104 | Shanta loam, 0 to 3 percent slopes | 45.4 | 1.0% |
| 118 | Travessilla-Rock outcrop complex, 5 to 50 percent slopes | 75.9 | 1.7% |
| 120 | Ustic Torriorthents, bouldery-Rock outcrop complex, 35 to 90 percent slopes | 1,712.7 | 37.4% |
| 121 | Ustic Torriorthents-Sedillo complex, 15 to 40 percent slopes | 115.3 | 2.5% |
| 125 | Wesix very channery loam, 5 to 40 percent slopes | 21.1 | 0.5% |
| 131 | Water | 26.2 | 0.6% |
| **Totals for Area of Interest** | | **4,574.7** | **100.0%** |

# Fremont County Area, Colorado

## 50—Kim loam, cool, 3 to 8 percent slopes

### Map Unit Setting

*National map unit symbol:* jqjr
*Elevation:* 5,300 to 6,100 feet
*Mean annual precipitation:* 13 to 15 inches
*Mean annual air temperature:* 48 to 51 degrees F
*Frost-free period:* 125 to 155 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Kim, cool, and similar soils:* 99 percent
*Minor components:* 1 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Kim, Cool

#### Setting

*Landform:* Fan terraces, fans
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Loamy alluvium and/or eolian deposits

#### Typical profile

*A - 0 to 3 inches:* loam
*C - 3 to 60 inches:* loam, fine sandy loam
*C - 3 to 60 inches:*

#### Properties and qualities

*Slope:* 3 to 8 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Well drained
*Runoff class:* Medium
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum in profile:* 10 percent
*Available water storage in profile:* Very high (about 17.5 inches)

#### Interpretive groups

*Land capability classification (irrigated):* 4e
*Land capability classification (nonirrigated):* 4c
*Hydrologic Soil Group:* B
*Ecological site:* Loamy Foothill 11-14 Inches P.Z. (R049XD202CO)
*Hydric soil rating:* No

### Minor Components

**Cascajo**

*Percent of map unit:* 1 percent
*Hydric soil rating:* No

## Data Source Information

Soil Survey Area: Fremont County Area, Colorado
Survey Area Data: Version 17, Sep 13, 2019

# Fremont County Area, Colorado

## 64—Louviers-Travessilla complex, 20 to 50 percent slopes

### Map Unit Setting

*National map unit symbol:* jqk7
*Elevation:* 5,300 to 6,800 feet
*Mean annual precipitation:* 13 to 15 inches
*Mean annual air temperature:* 48 to 52 degrees F
*Frost-free period:* 120 to 150 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Louviers and similar soils:* 50 percent
*Travessilla and similar soils:* 45 percent
*Minor components:* 5 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Louviers

#### Setting

*Landform:* Canyons, hogbacks, hills
*Landform position (three-dimensional):* Crest
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Residuum weathered from shale and siltstone

#### Typical profile

*A - 0 to 3 inches:* very channery clay loam
*C - 3 to 16 inches:* clay, clay loam
*C - 3 to 16 inches:* weathered bedrock
*Cr - 16 to 20 inches:*

#### Properties and qualities

*Slope:* 20 to 50 percent
*Depth to restrictive feature:* 10 to 20 inches to paralithic bedrock
*Natural drainage class:* Well drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water storage in profile:* Low (about 4.5 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7e
*Hydrologic Soil Group:* D
*Hydric soil rating:* No

## Description of Travessilla

### Setting

*Landform:* Canyons, hills, hogbacks
*Landform position (three-dimensional):* Crest
*Down-slope shape:* Linear
*Across-slope shape:* Linear

### Typical profile

*A - 0 to 4 inches:* channery loam
*C - 4 to 14 inches:* channery loam
*R - 14 to 18 inches:* unweathered bedrock

### Properties and qualities

*Slope:* 20 to 50 percent
*Depth to restrictive feature:* 4 to 20 inches to lithic bedrock
*Natural drainage class:* Well drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum in profile:* 15 percent
*Salinity, maximum in profile:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water storage in profile:* Very low (about 1.7 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7e
*Hydrologic Soil Group:* D
*Hydric soil rating:* No

## Minor Components

### Cascajo

*Percent of map unit:* 1 percent
*Hydric soil rating:* No

### Kim

*Percent of map unit:* 1 percent
*Hydric soil rating:* No

### Moderately deep soils

*Percent of map unit:* 1 percent
*Hydric soil rating:* No

### Rock outcrop

*Percent of map unit:* 1 percent
*Hydric soil rating:* No

### Shingle

*Percent of map unit:* 1 percent

*Hydric soil rating:* No

## Data Source Information

Soil Survey Area: Fremont County Area, Colorado
Survey Area Data: Version 17, Sep 13, 2019

# Fremont County Area, Colorado

## 81—Otero fine sandy loam, 3 to 8 percent slopes

### Map Unit Setting

*National map unit symbol:* jqkv
*Elevation:* 5,300 to 5,900 feet
*Mean annual precipitation:* 12 to 14 inches
*Mean annual air temperature:* 49 to 52 degrees F
*Frost-free period:* 130 to 155 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Otero and similar soils:* 99 percent
*Minor components:* 1 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Otero

#### Setting

*Landform:* Fans, hills
*Landform position (two-dimensional):* Footslope
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Alluvium and/or fine eolian sands

#### Typical profile

*A - 0 to 2 inches:* fine sandy loam
*C - 2 to 60 inches:* fine sandy loam

#### Properties and qualities

*Slope:* 3 to 8 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Well drained
*Runoff class:* Low
*Capacity of the most limiting layer to transmit water (Ksat):* High (2.00 to 6.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum in profile:* 10 percent
*Salinity, maximum in profile:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water storage in profile:* Moderate (about 7.2 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 4c
*Hydrologic Soil Group:* A
*Ecological site:* Sandy Foothill (R049BY210CO)

*Hydric soil rating:* No

**Minor Components**

**Kim**

*Percent of map unit:* 1 percent
*Hydric soil rating:* No

# Data Source Information

Soil Survey Area: Fremont County Area, Colorado
Survey Area Data: Version 17, Sep 13, 2019

# Fremont County Area, Colorado

## 98—Roygorge very gravelly sandy clay loam, 25 to 50 percent slopes

### Map Unit Setting

*National map unit symbol:* jqlf
*Elevation:* 6,200 to 6,900 feet
*Mean annual precipitation:* 11 to 14 inches
*Mean annual air temperature:* 47 to 52 degrees F
*Frost-free period:* 120 to 150 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Roygorge and similar soils:* 85 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Roygorge

#### Setting

*Landform:* Mountainsides
*Landform position (three-dimensional):* Mountainflank
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Residuum weathered from gneiss and/or residuum weathered from granite

#### Typical profile

*A - 0 to 2 inches:* very gravelly sandy clay loam
*Bt - 2 to 11 inches:* very gravelly sandy clay loam, extremely gravelly sandy clay loam
*Bt - 2 to 11 inches:* unweathered bedrock
*Bkm - 11 to 12 inches:* unweathered bedrock
*R - 12 to 16 inches:*

#### Properties and qualities

*Slope:* 25 to 50 percent
*Depth to restrictive feature:* 8 to 20 inches to lithic bedrock
*Natural drainage class:* Well drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum in profile:* 15 percent
*Available water storage in profile:* Very low (about 1.4 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7e

*Hydrologic Soil Group:* D
*Hydric soil rating:* No

**Minor Components**

**Wages**
*Percent of map unit:*
*Hydric soil rating:* No

**Sedillo**
*Percent of map unit:*
*Hydric soil rating:* No

**Rock outcrop**
*Percent of map unit:*
*Hydric soil rating:* No

## Data Source Information

Soil Survey Area: Fremont County Area, Colorado
Survey Area Data: Version 17, Sep 13, 2019

# Fremont County Area, Colorado

## 104—Shanta loam, 0 to 3 percent slopes

### Map Unit Setting

*National map unit symbol:* jqgh
*Elevation:* 5,800 to 6,300 feet
*Mean annual precipitation:* 13 to 15 inches
*Mean annual air temperature:* 48 to 52 degrees F
*Frost-free period:* 120 to 140 days
*Farmland classification:* Prime farmland if irrigated

### Map Unit Composition

*Shanta and similar soils:* 85 percent
*Minor components:* 15 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Shanta

#### Setting

*Landform:* Stream terraces
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Alluvium

#### Typical profile

*A - 0 to 49 inches:* loam
*C - 49 to 60 inches:* stratified loamy sand to sandy loam

#### Properties and qualities

*Slope:* 0 to 3 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Well drained
*Runoff class:* Low
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* Rare
*Frequency of ponding:* None
*Calcium carbonate, maximum in profile:* 5 percent
*Salinity, maximum in profile:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water storage in profile:* Moderate (about 8.3 inches)

#### Interpretive groups

*Land capability classification (irrigated):* 2e
*Land capability classification (nonirrigated):* 4c
*Hydrologic Soil Group:* B
*Ecological site:* Loamy Foothill 11-14 Inches P.Z. (R049XD202CO)
*Hydric soil rating:* No

### Minor Components

**Cascajo**

*Percent of map unit:* 10 percent
*Hydric soil rating:* No

**Very poorly drained soils**

*Percent of map unit:* 5 percent
*Landform:* Flood-plain steps
*Hydric soil rating:* Yes

## Data Source Information

Soil Survey Area: Fremont County Area, Colorado
Survey Area Data: Version 17, Sep 13, 2019

# Fremont County Area, Colorado

## 120—Ustic Torriorthents, bouldery-Rock outcrop complex, 35 to 90 percent slopes

### Map Unit Setting

*National map unit symbol:* jqh2
*Elevation:* 6,800 to 8,500 feet
*Mean annual precipitation:* 11 to 15 inches
*Mean annual air temperature:* 43 to 47 degrees F
*Frost-free period:* 95 to 120 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Ustic torriorthents and similar soils:* 55 percent
*Rock outcrop:* 30 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Ustic Torriorthents

#### Setting

*Landform:* Mountainsides
*Landform position (three-dimensional):* Mountainflank
*Down-slope shape:* Concave
*Across-slope shape:* Concave
*Parent material:* Colluvium derived from granite and gneiss and/or residuum weathered from granite and gneiss

#### Typical profile

*A - 0 to 4 inches:* very bouldery sandy loam
*C - 4 to 7 inches:* extremely gravelly sandy loam, extremely gravelly coarse sandy loam
*C - 4 to 7 inches:* weathered bedrock
*Cr - 7 to 18 inches:* unweathered bedrock
*R - 18 to 22 inches:*

#### Properties and qualities

*Slope:* 35 to 80 percent
*Depth to restrictive feature:* 4 to 30 inches to paralithic bedrock
*Natural drainage class:* Well drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum in profile:* 2 percent
*Available water storage in profile:* Very low (about 0.5 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 7s
*Hydrologic Soil Group:* D
*Hydric soil rating:* No

### Description of Rock Outcrop

**Typical profile**
*R - 0 to 60 inches:* unweathered bedrock

**Interpretive groups**
*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 8s
*Hydric soil rating:* No

### Minor Components

**Bronell**
*Percent of map unit:*
*Hydric soil rating:* No

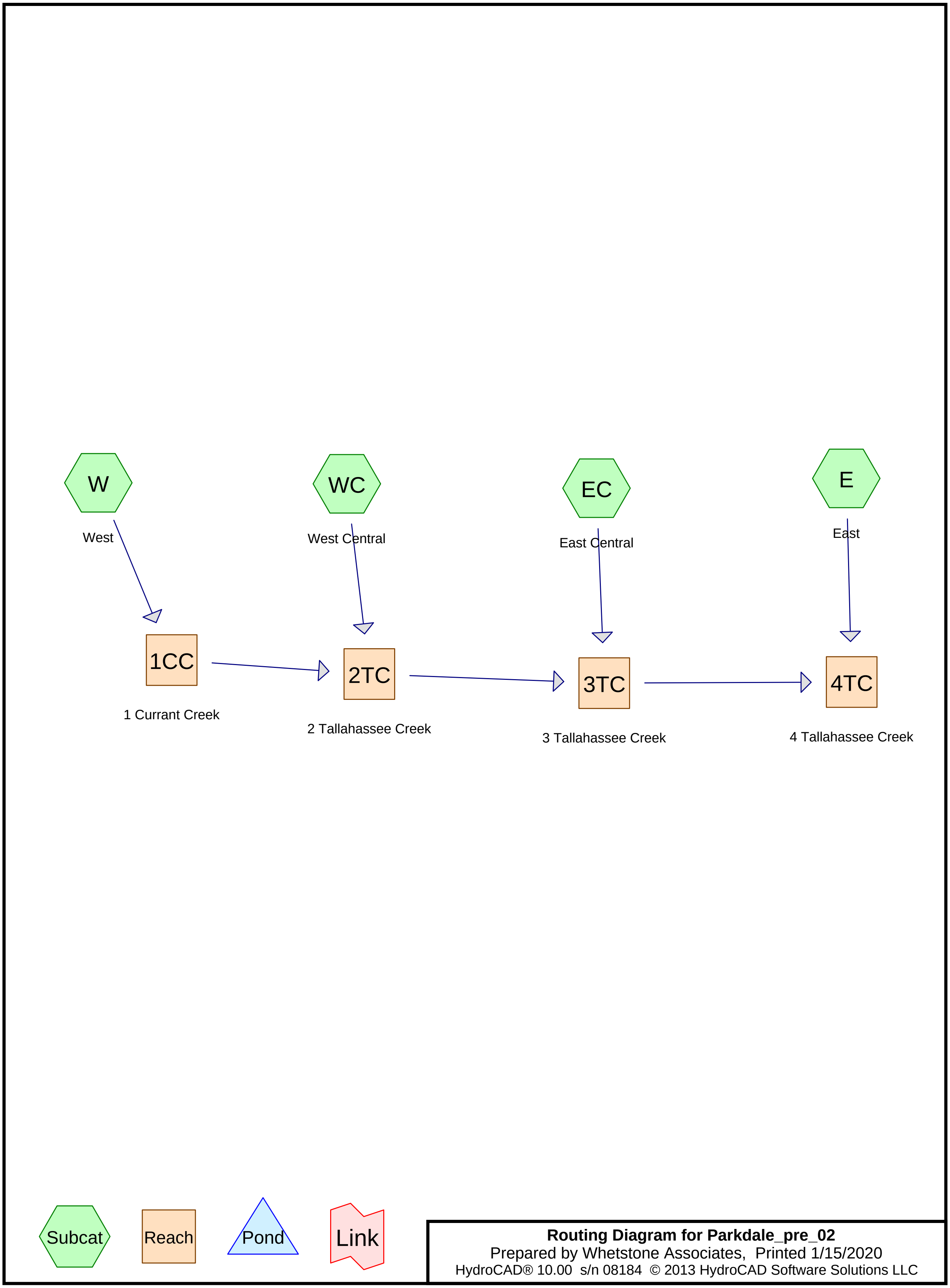
**Talus**
*Percent of map unit:*
*Hydric soil rating:* No

**Cascajo variant**
*Percent of map unit:*
*Hydric soil rating:* No

## Data Source Information

Soil Survey Area: Fremont County Area, Colorado
Survey Area Data: Version 17, Sep 13, 2019

## *Attachment 3. HydroCAD Model Reports*



**Routing Diagram for Parkdale_pre_02**
Prepared by Whetstone Associates, Printed 1/15/2020
HydroCAD® 10.00 s/n 08184 © 2013 HydroCAD Software Solutions LLC

## Area Listing (all nodes)

| Area<br>(acres) | CN | Description<br>(subcatchment-numbers) |
|---|---|---|
| 462.222 | 80 | Pinyon/juniper range, Fair, HSG D (E, EC, W, WC) |
| 577.778 | 71 | Pinyon/juniper range, Good, HSG D (E, EC, W, WC) |
| **1,040.000** | **75** | **TOTAL AREA** |

## Soil Listing (all nodes)

| Area (acres) | Soil Group | Subcatchment Numbers |
|---:|---|---|
| 0.000 | HSG A | |
| 0.000 | HSG B | |
| 0.000 | HSG C | |
| 1,040.000 | HSG D | E, EC, W, WC |
| 0.000 | Other | |
| **1,040.000** | | **TOTAL AREA** |

## Ground Covers (all nodes)

| HSG-A (acres) | HSG-B (acres) | HSG-C (acres) | HSG-D (acres) | Other (acres) | Total (acres) | Ground Cover | Subcatchment Numbers |
|---|---|---|---|---|---|---|---|
| 0.000 | 0.000 | 0.000 | 462.222 | 0.000 | 462.222 | Pinyon/juniper range, Fair | E, EC, W, WC |
| 0.000 | 0.000 | 0.000 | 577.778 | 0.000 | 577.778 | Pinyon/juniper range, Good | E, EC, W, WC |
| **0.000** | **0.000** | **0.000** | **1,040.000** | **0.000** | **1,040.000** | **TOTAL AREA** | |

Time span=1.00-35.00 hrs, dt=0.05 hrs, 681 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E: East** Runoff Area=250.000 ac Runoff Depth=0.24"
Flow Length=5,925' Tc=25.0 min CN=75 Runoff=38.24 cfs 5.008 af

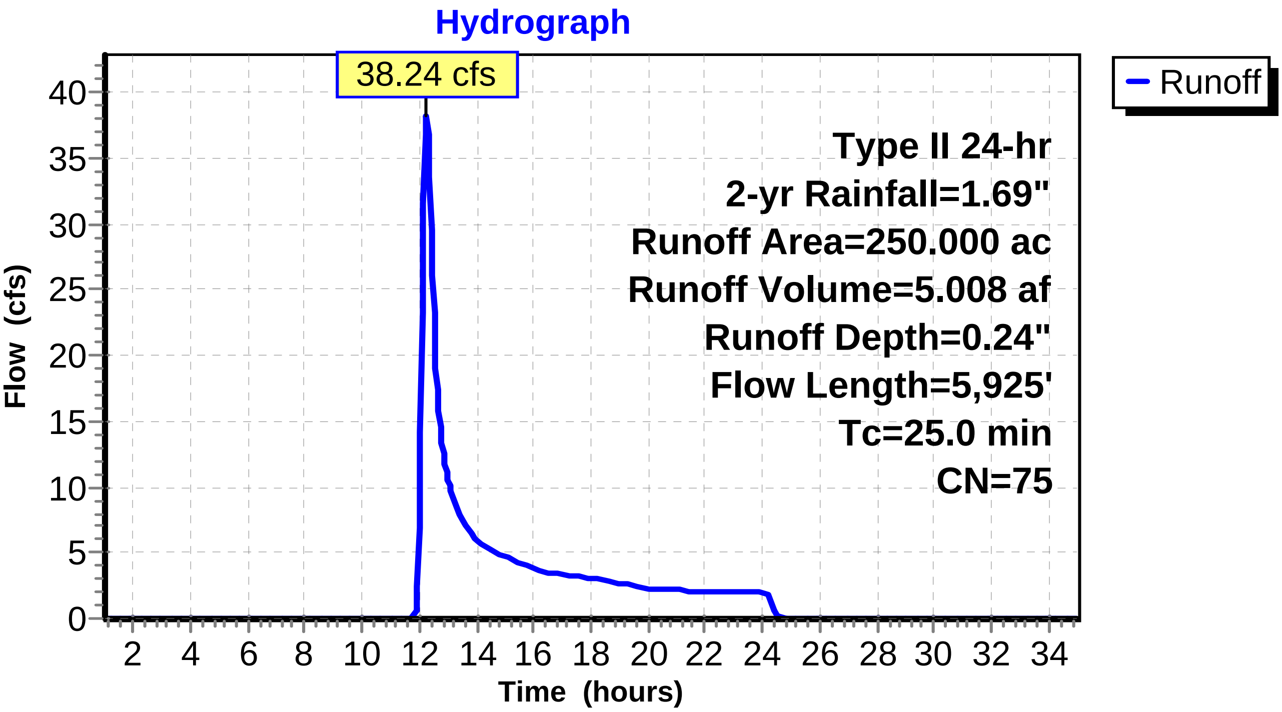
**Subcatchment EC: East Central** Runoff Area=320.000 ac Runoff Depth=0.24"
Flow Length=7,295' Tc=32.2 min CN=75 Runoff=40.98 cfs 6.410 af

**Subcatchment W: West** Runoff Area=180.000 ac Runoff Depth=0.24"
Flow Length=6,335' Tc=36.1 min CN=75 Runoff=21.30 cfs 3.606 af

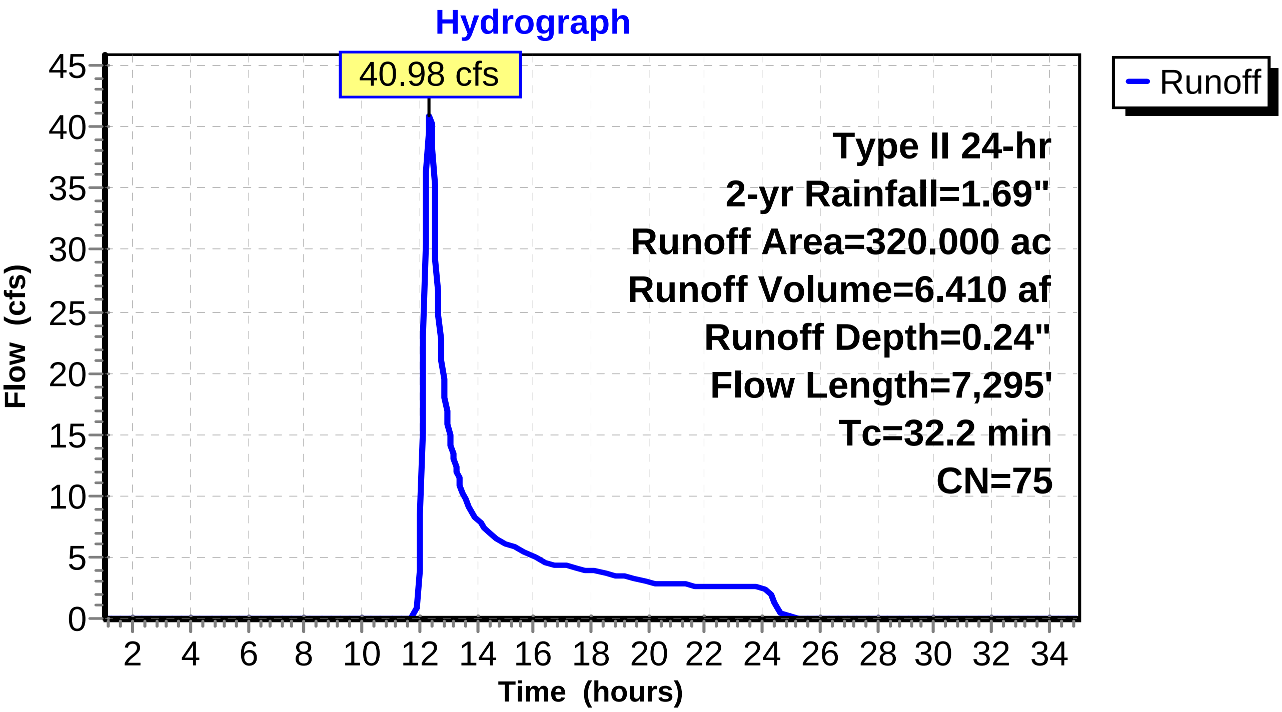
**Subcatchment WC: West Central** Runoff Area=290.000 ac Runoff Depth=0.24"
Flow Length=7,497' Tc=35.9 min CN=75 Runoff=34.44 cfs 5.809 af

**Total Runoff Area = 1,040.000 ac Runoff Volume = 20.832 af Average Runoff Depth = 0.24"**

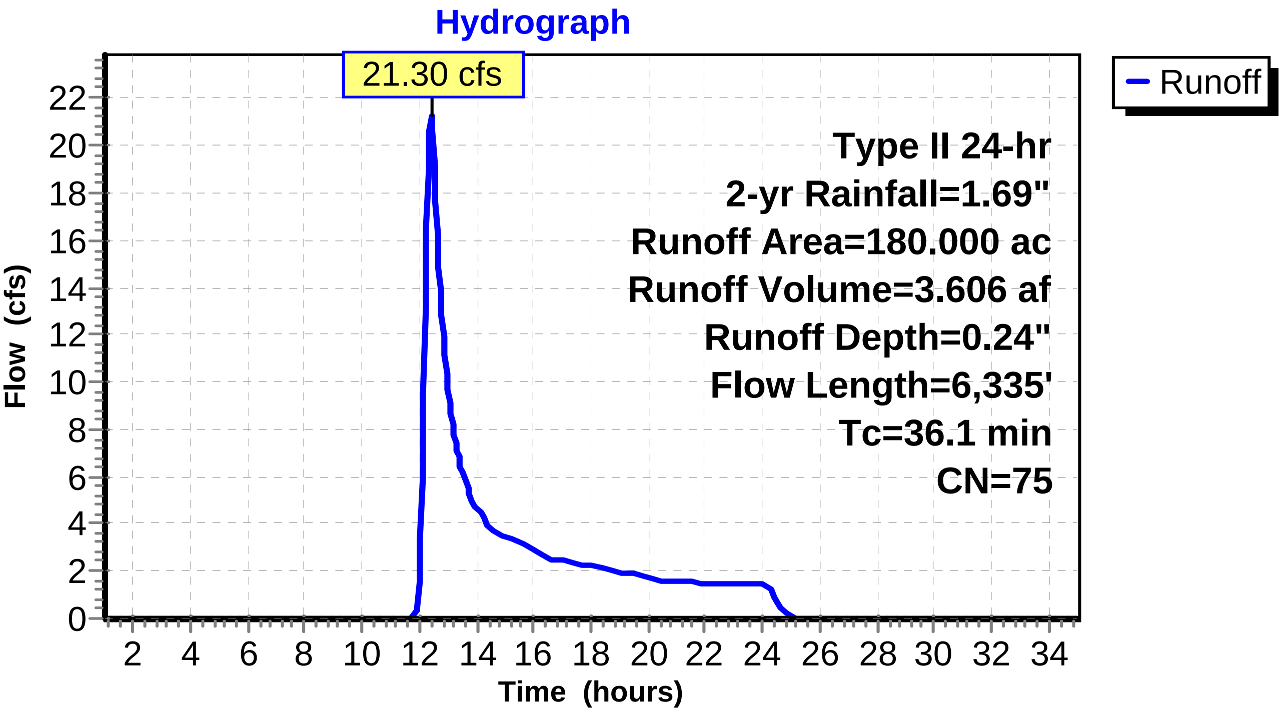
## Subcatchment E: East



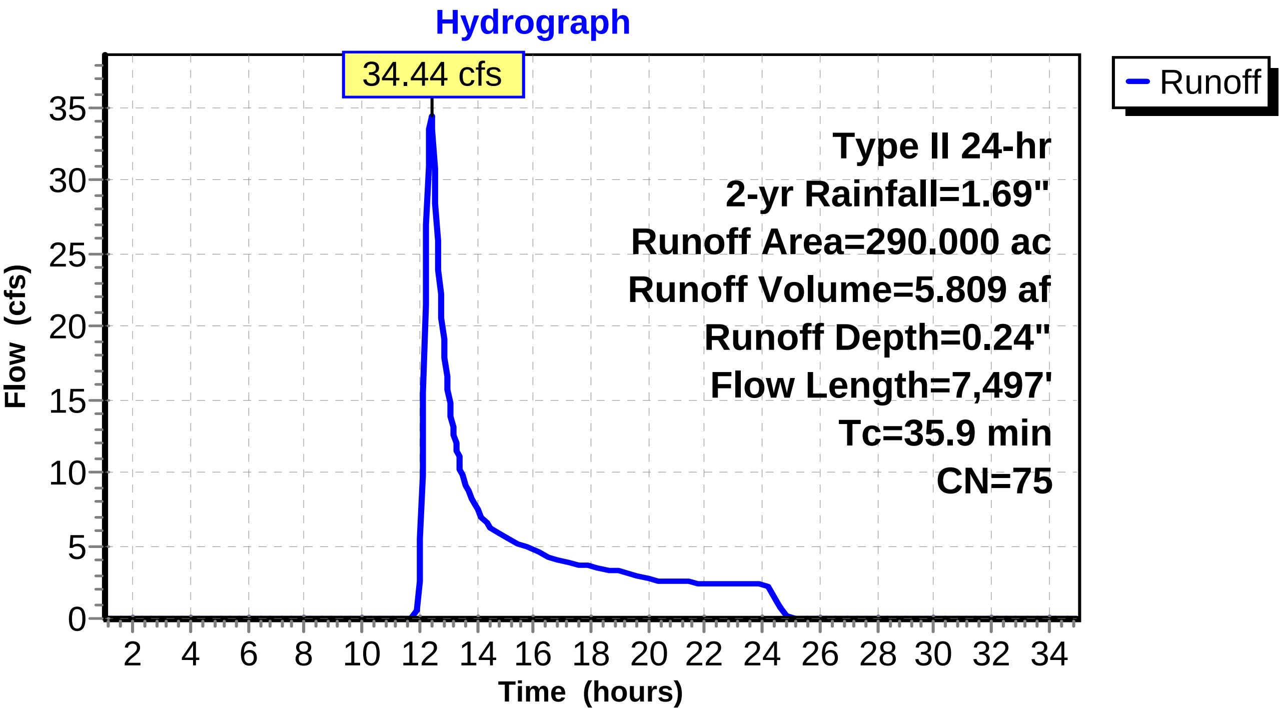
## Subcatchment EC: East Central



## Subcatchment W: West



## Subcatchment WC: West Central



Time span=1.00-35.00 hrs, dt=0.05 hrs, 681 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E: East** Runoff Area=250.000 ac Runoff Depth=0.44"
Flow Length=5,925' Tc=25.0 min CN=75 Runoff=87.04 cfs 9.193 af

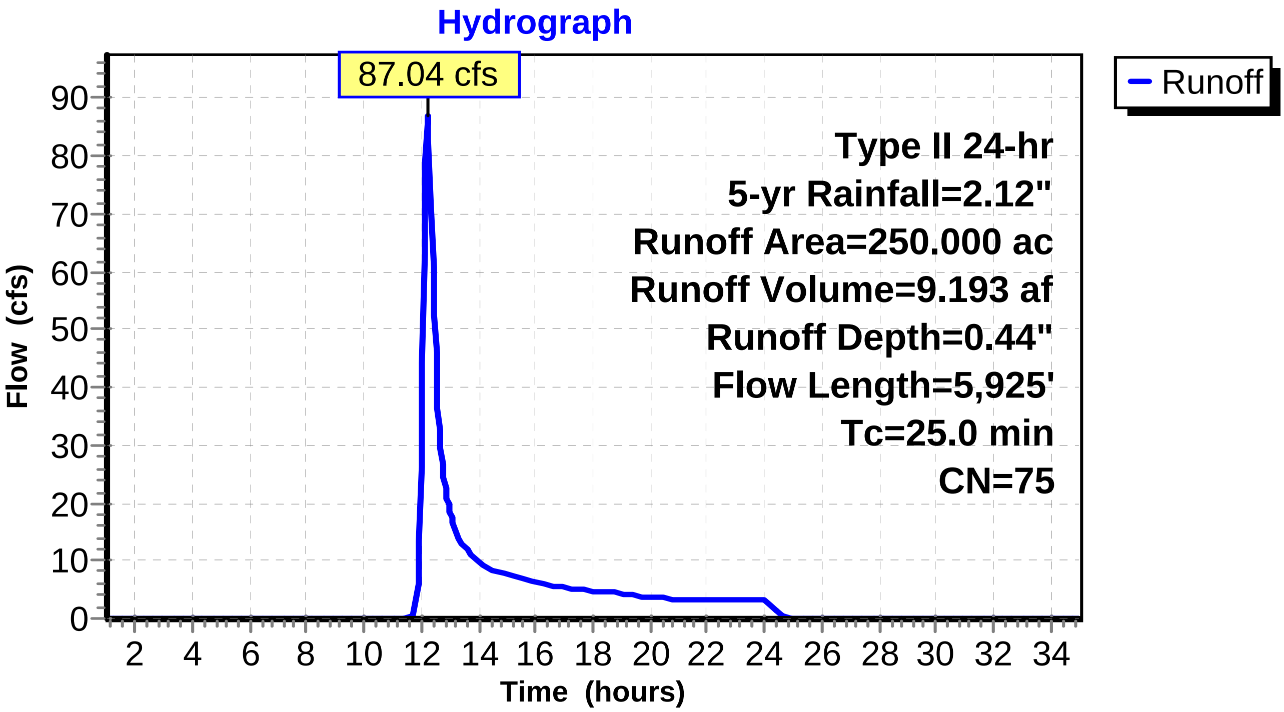
**Subcatchment EC: East Central** Runoff Area=320.000 ac Runoff Depth=0.44"
Flow Length=7,295' Tc=32.2 min CN=75 Runoff=92.90 cfs 11.767 af

**Subcatchment W: West** Runoff Area=180.000 ac Runoff Depth=0.44"
Flow Length=6,335' Tc=36.1 min CN=75 Runoff=48.12 cfs 6.619 af

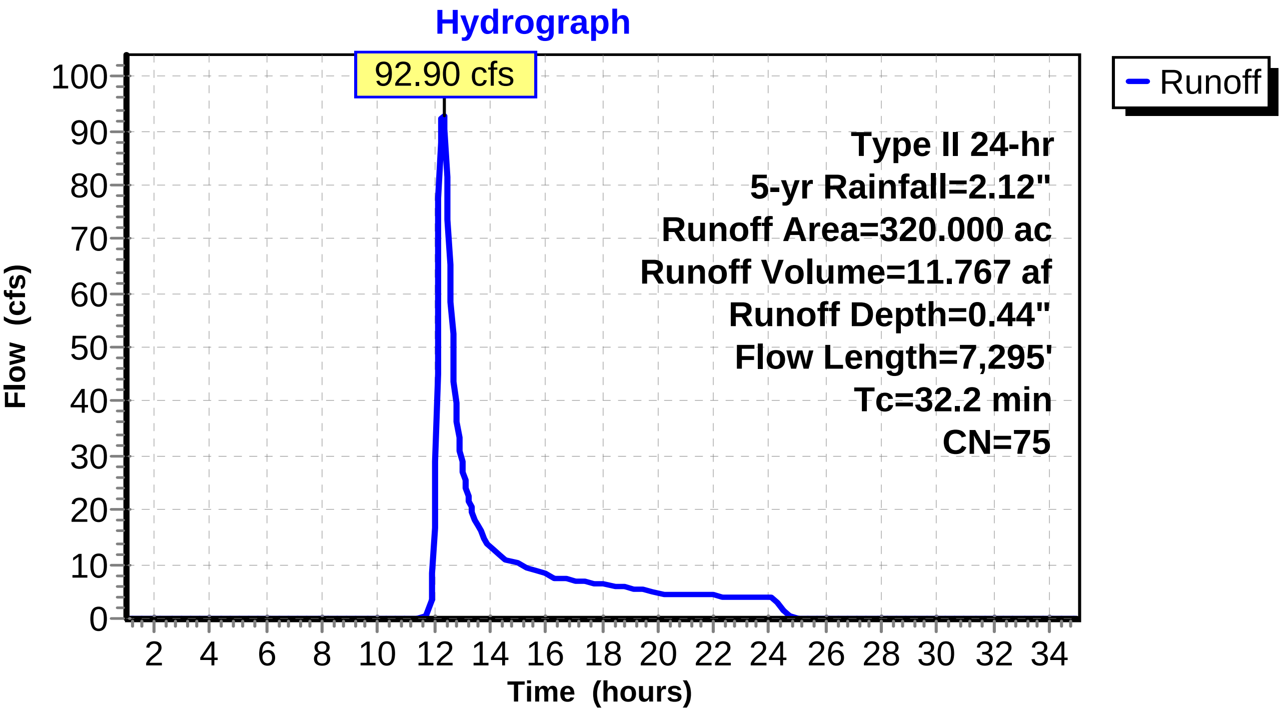
**Subcatchment WC: West Central** Runoff Area=290.000 ac Runoff Depth=0.44"
Flow Length=7,497' Tc=35.9 min CN=75 Runoff=77.84 cfs 10.664 af

**Total Runoff Area = 1,040.000 ac Runoff Volume = 38.243 af Average Runoff Depth = 0.44"**

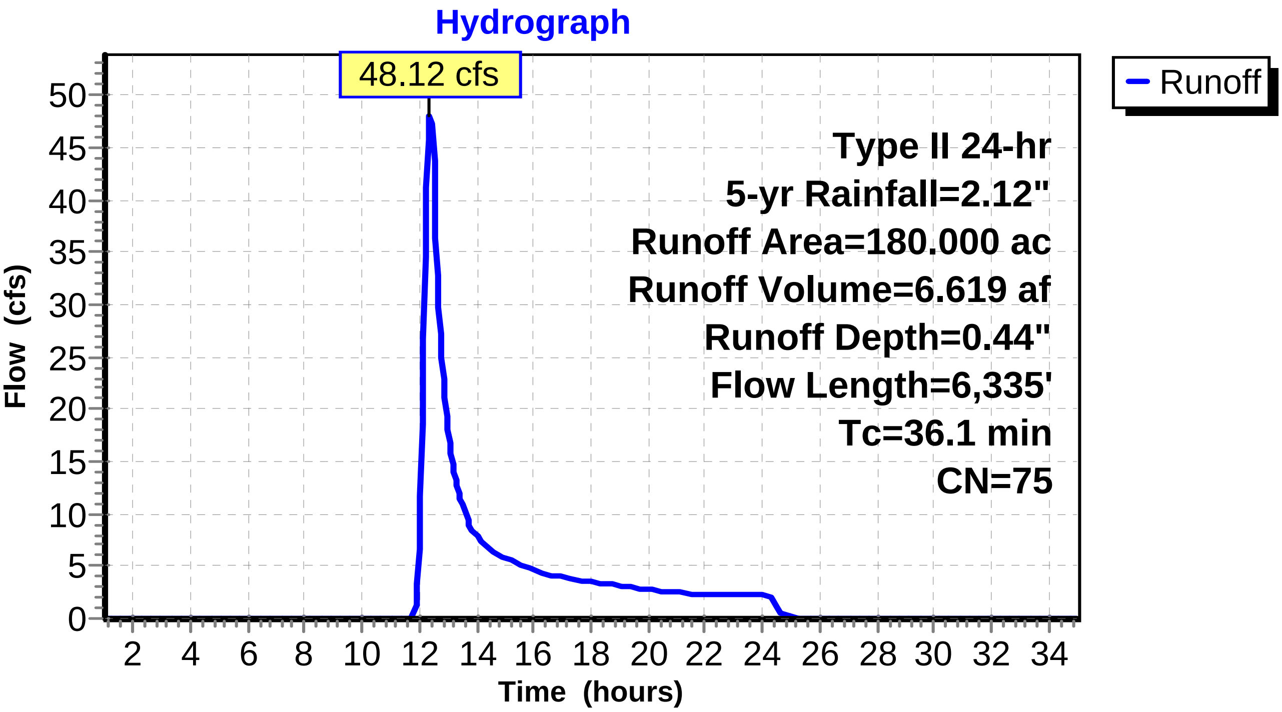
## Subcatchment E: East



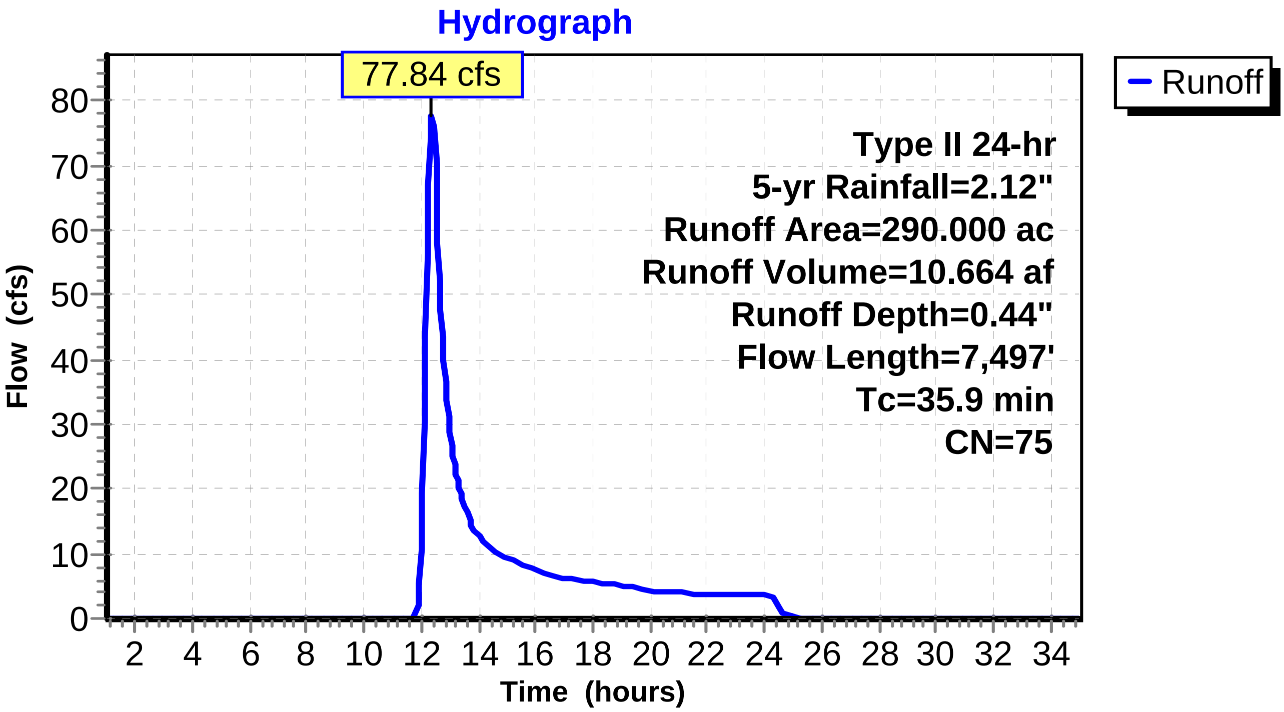
## Subcatchment EC: East Central



## Subcatchment W: West



## Subcatchment WC: West Central

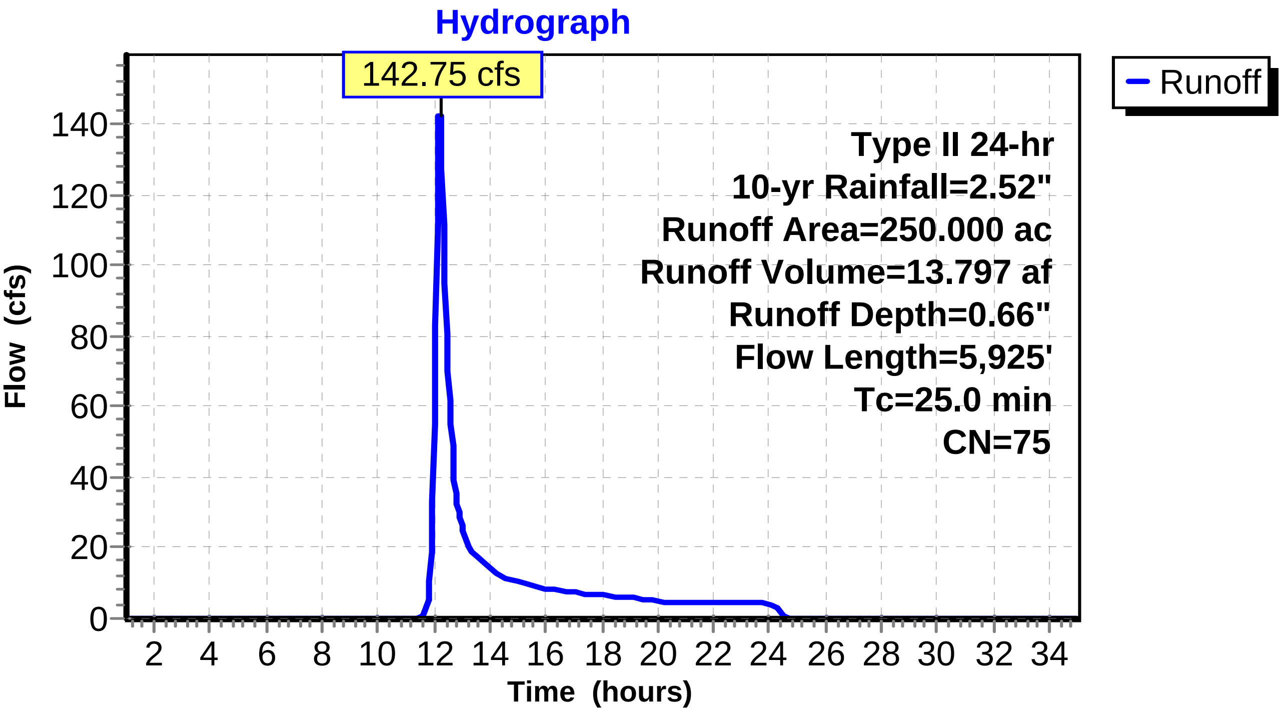


Time span=1.00-35.00 hrs, dt=0.05 hrs, 681 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

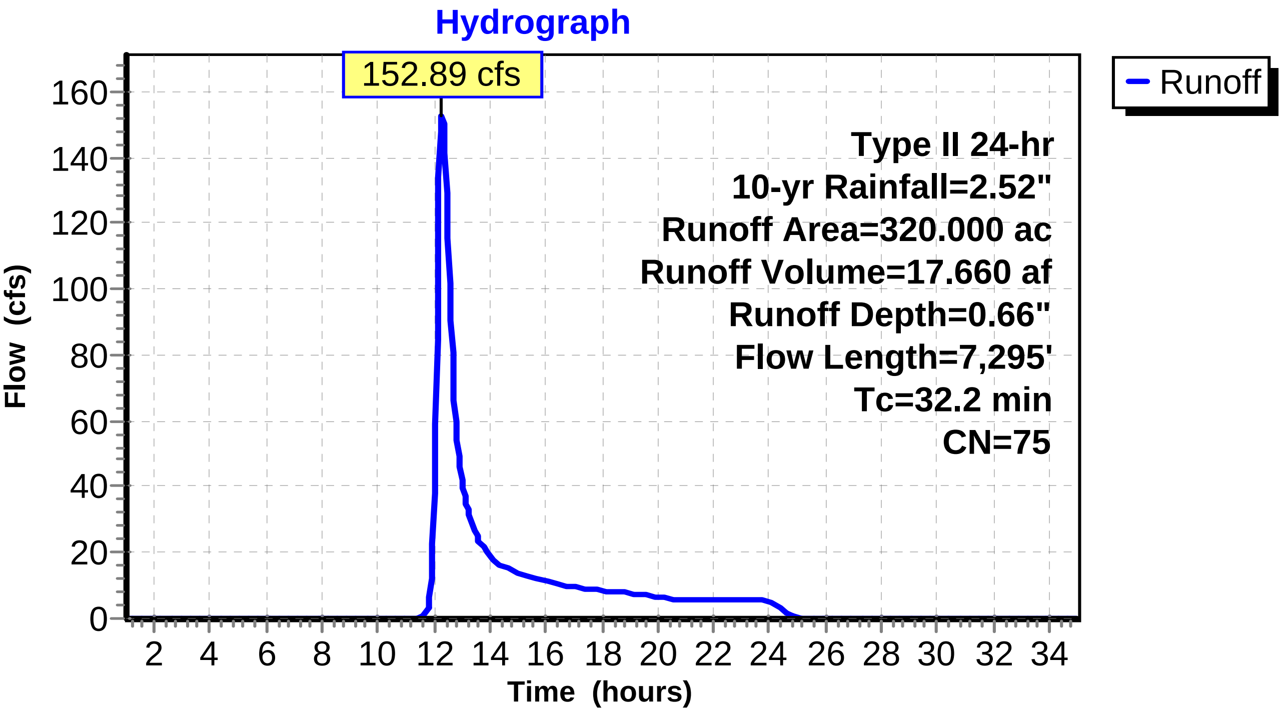
```
Subcatchment E: East                            Runoff Area=250.000 ac   Runoff Depth=0.66"
                          Flow Length=5,925'   Tc=25.0 min   CN=75   Runoff=142.75 cfs  13.797 af

Subcatchment EC: East Central                   Runoff Area=320.000 ac   Runoff Depth=0.66"
                          Flow Length=7,295'   Tc=32.2 min   CN=75   Runoff=152.89 cfs  17.660 af

Subcatchment W: West                            Runoff Area=180.000 ac   Runoff Depth=0.66"
                            Flow Length=6,335'   Tc=36.1 min   CN=75   Runoff=79.24 cfs  9.934 af

Subcatchment WC: West Central                   Runoff Area=290.000 ac   Runoff Depth=0.66"
                          Flow Length=7,497'   Tc=35.9 min   CN=75   Runoff=128.30 cfs  16.004 af
```

**Total Runoff Area = 1,040.000 ac Runoff Volume = 57.395 af Average Runoff Depth = 0.66"**

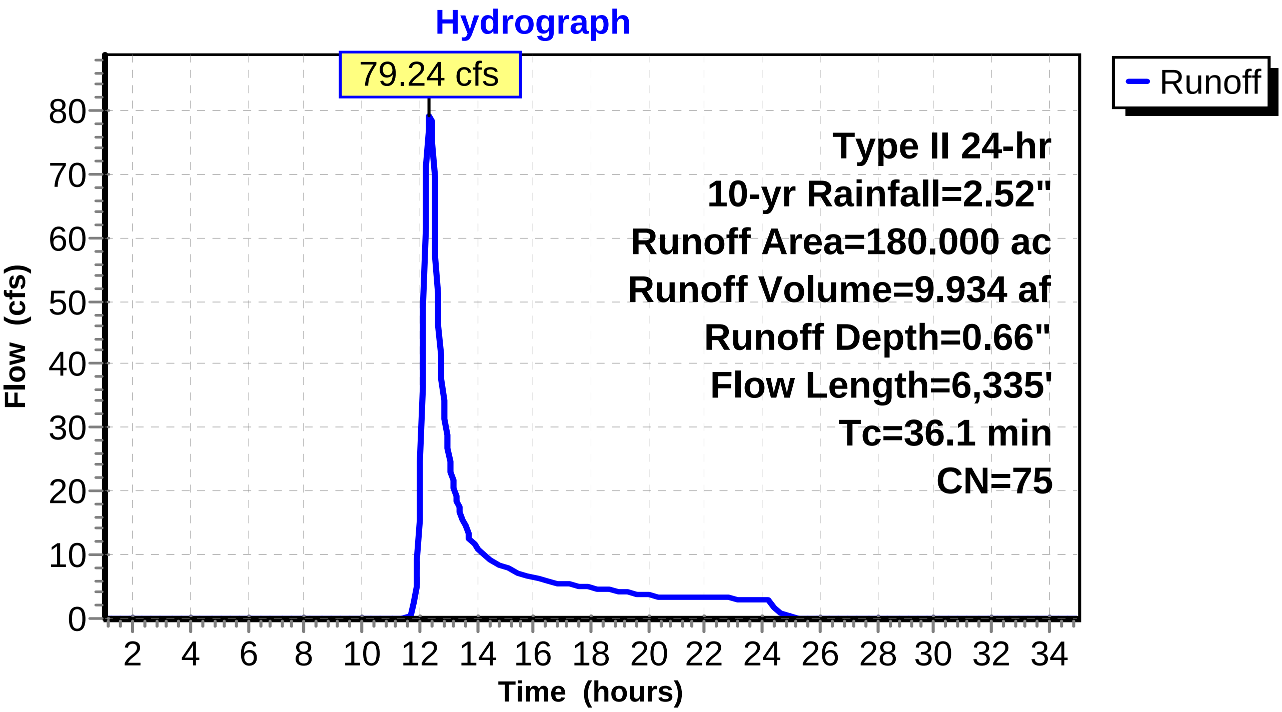
## Subcatchment E: East



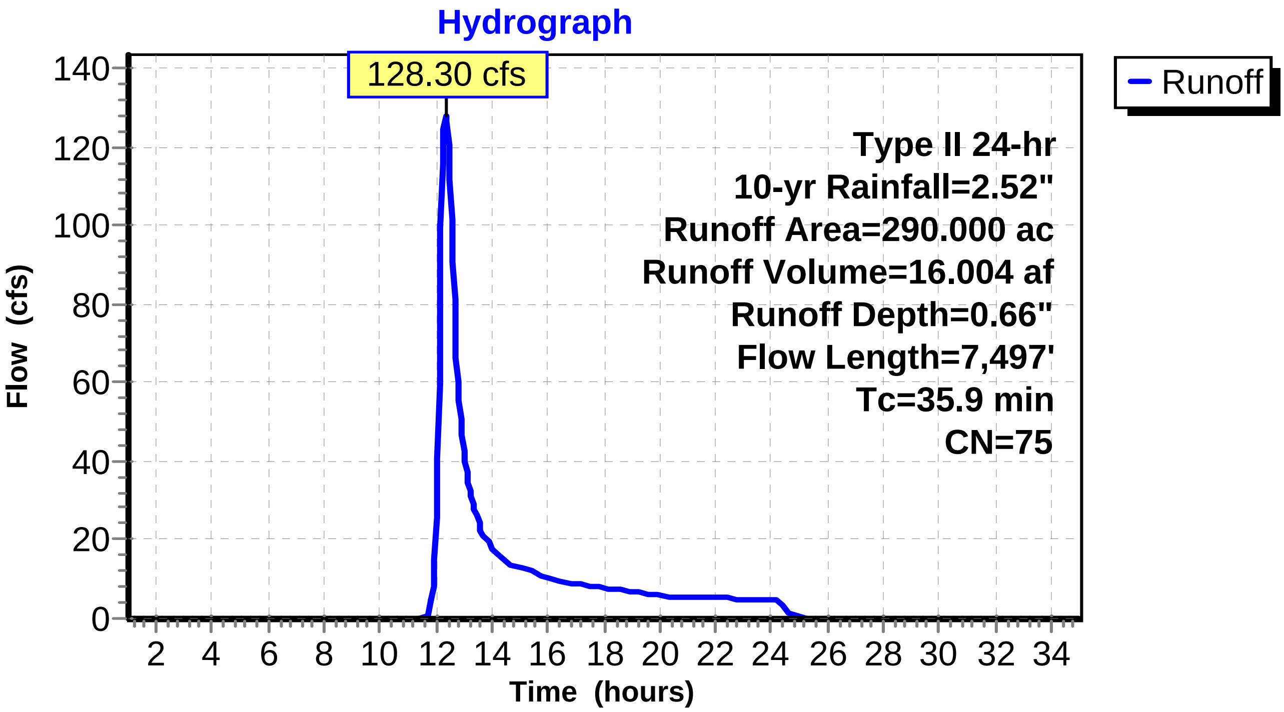
## Subcatchment EC: East Central



## Subcatchment W: West



## Subcatchment WC: West Central



Time span=1.00-35.00 hrs, dt=0.05 hrs, 681 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E: East** Runoff Area=250.000 ac Runoff Depth=1.07"
Flow Length=5,925' Tc=25.0 min CN=75 Runoff=246.89 cfs 22.368 af

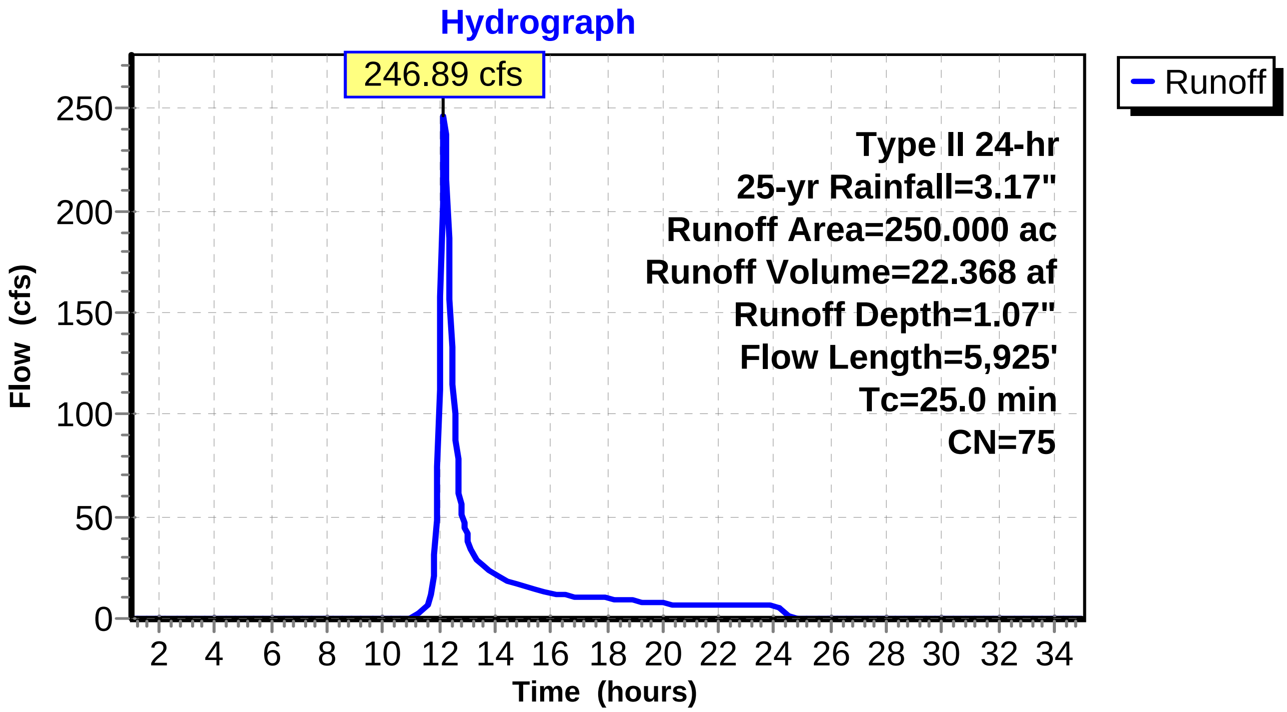
**Subcatchment EC: East Central** Runoff Area=320.000 ac Runoff Depth=1.07"
Flow Length=7,295' Tc=32.2 min CN=75 Runoff=265.84 cfs 28.631 af

**Subcatchment W: West** Runoff Area=180.000 ac Runoff Depth=1.07"
Flow Length=6,335' Tc=36.1 min CN=75 Runoff=138.02 cfs 16.105 af

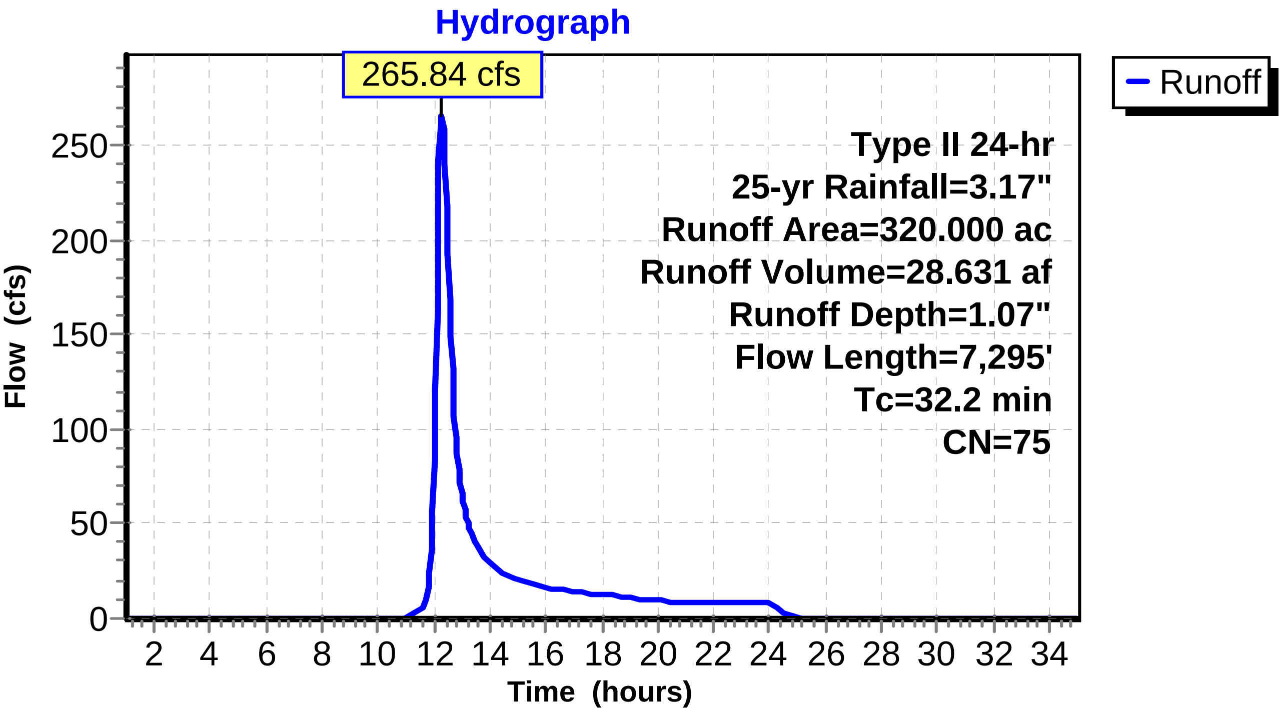
**Subcatchment WC: West Central** Runoff Area=290.000 ac Runoff Depth=1.07"
Flow Length=7,497' Tc=35.9 min CN=75 Runoff=223.46 cfs 25.947 af

**Total Runoff Area = 1,040.000 ac Runoff Volume = 93.052 af Average Runoff Depth = 1.07"**

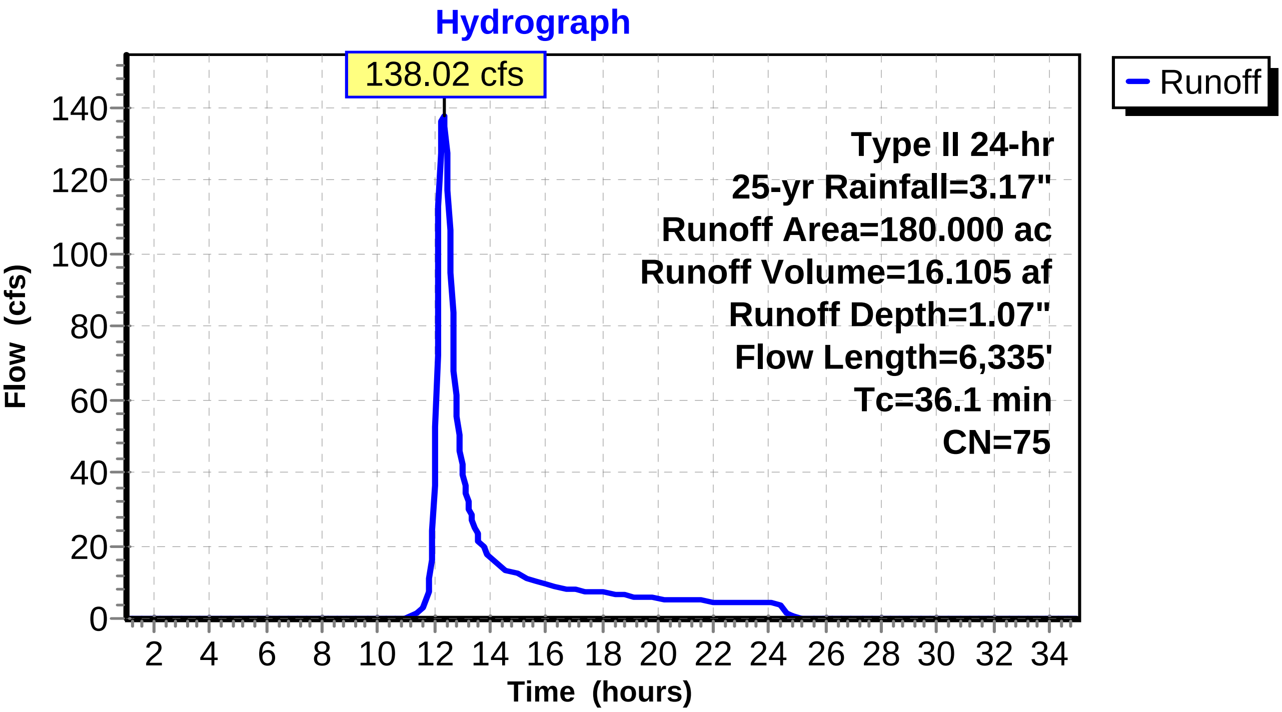
## Subcatchment E: East



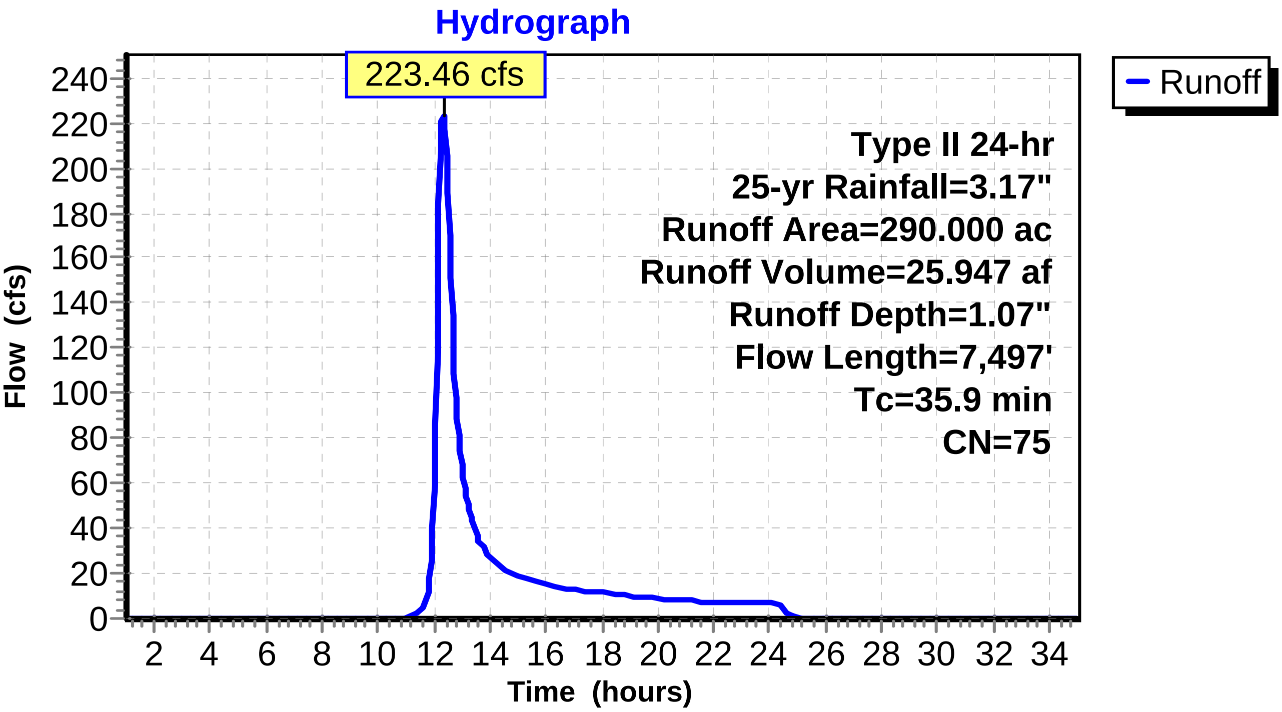
## Subcatchment EC: East Central



## Subcatchment W: West



## Subcatchment WC: West Central



Time span=1.00-35.00 hrs, dt=0.05 hrs, 681 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment E: East** Runoff Area=250.000 ac Runoff Depth=1.47"
Flow Length=5,925' Tc=25.0 min CN=75 Runoff=345.98 cfs 30.563 af

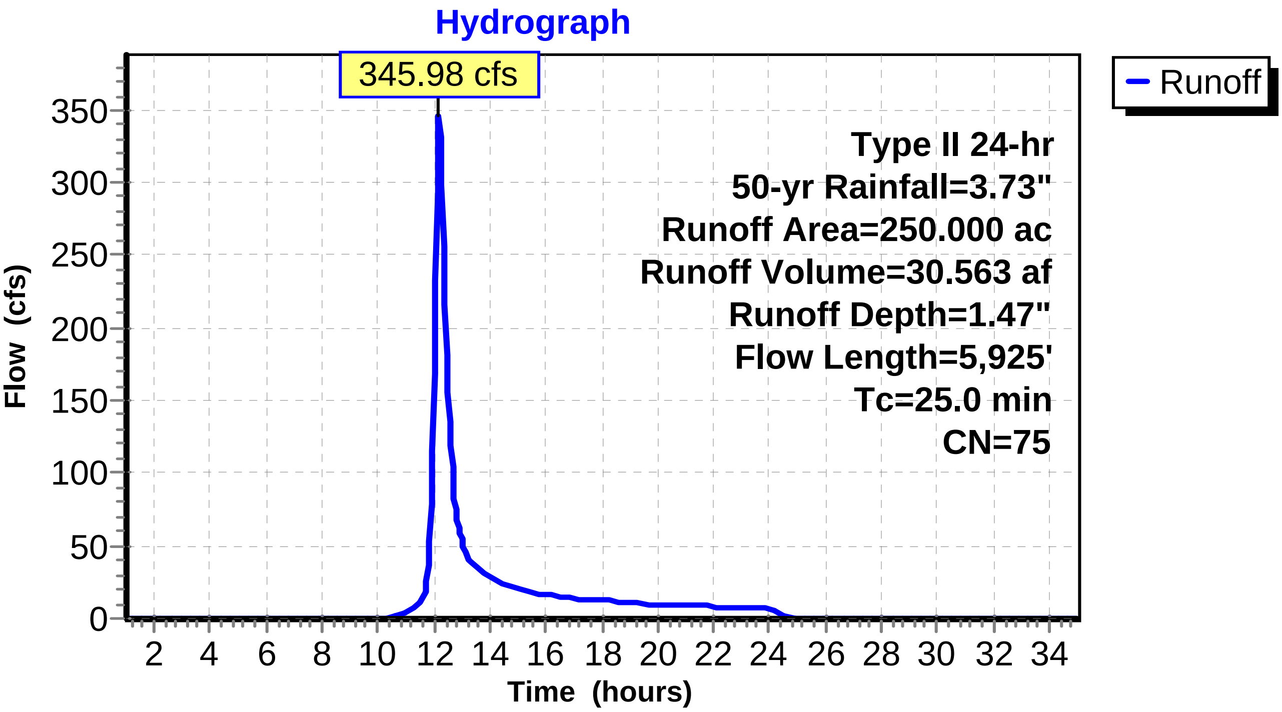
**Subcatchment EC: East Central** Runoff Area=320.000 ac Runoff Depth=1.47"
Flow Length=7,295' Tc=32.2 min CN=75 Runoff=373.65 cfs 39.120 af

**Subcatchment W: West** Runoff Area=180.000 ac Runoff Depth=1.47"
Flow Length=6,335' Tc=36.1 min CN=75 Runoff=194.21 cfs 22.005 af

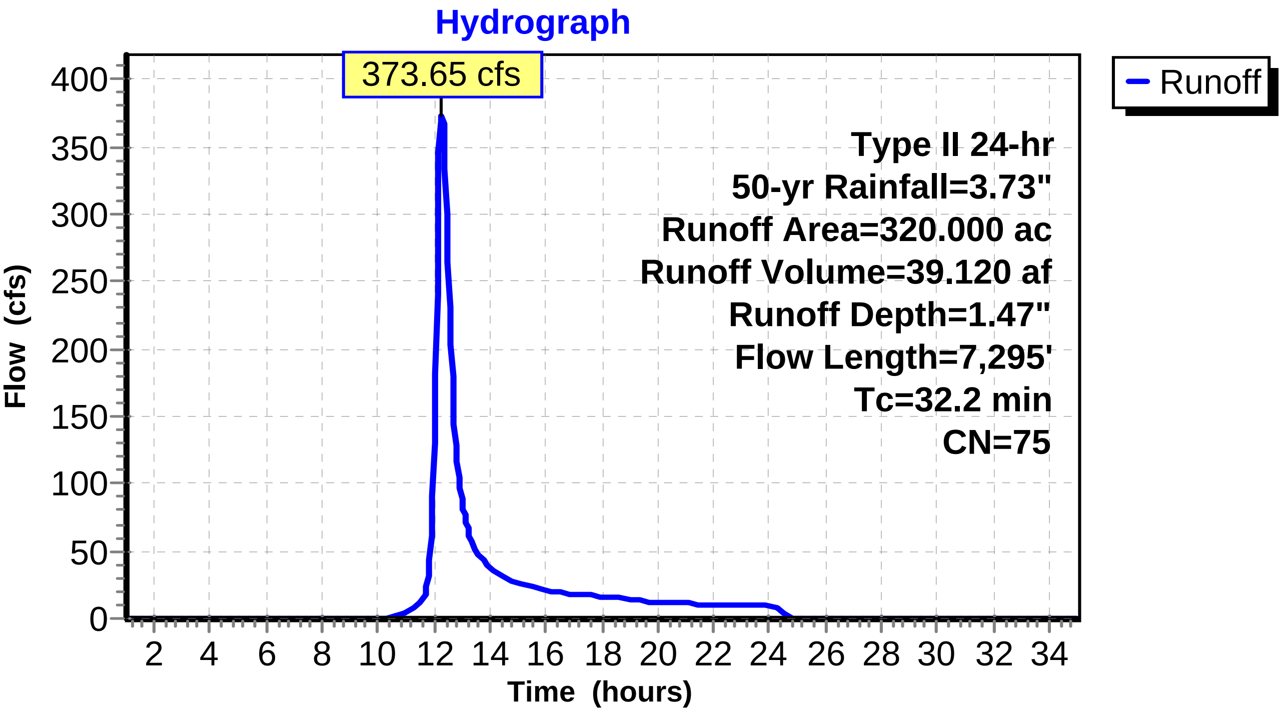
**Subcatchment WC: West Central** Runoff Area=290.000 ac Runoff Depth=1.47"
Flow Length=7,497' Tc=35.9 min CN=75 Runoff=314.38 cfs 35.453 af

**Total Runoff Area = 1,040.000 ac Runoff Volume = 127.141 af Average Runoff Depth = 1.47"**

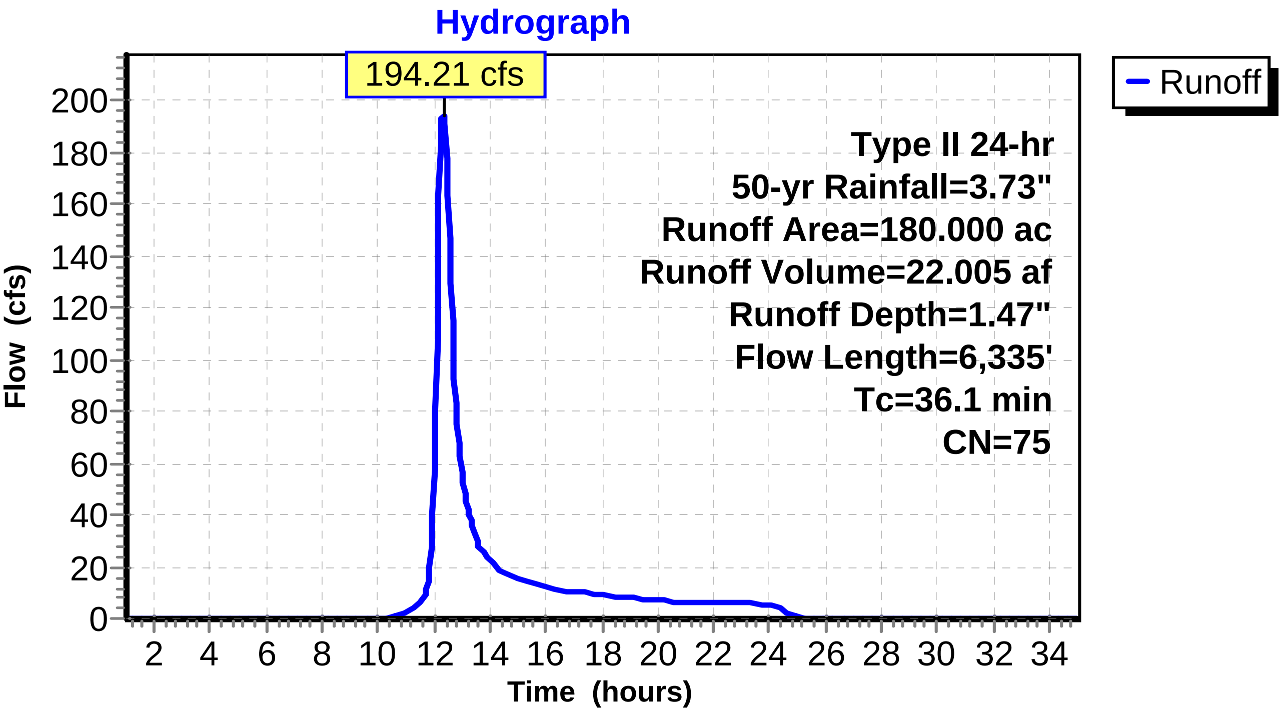
## Subcatchment E: East



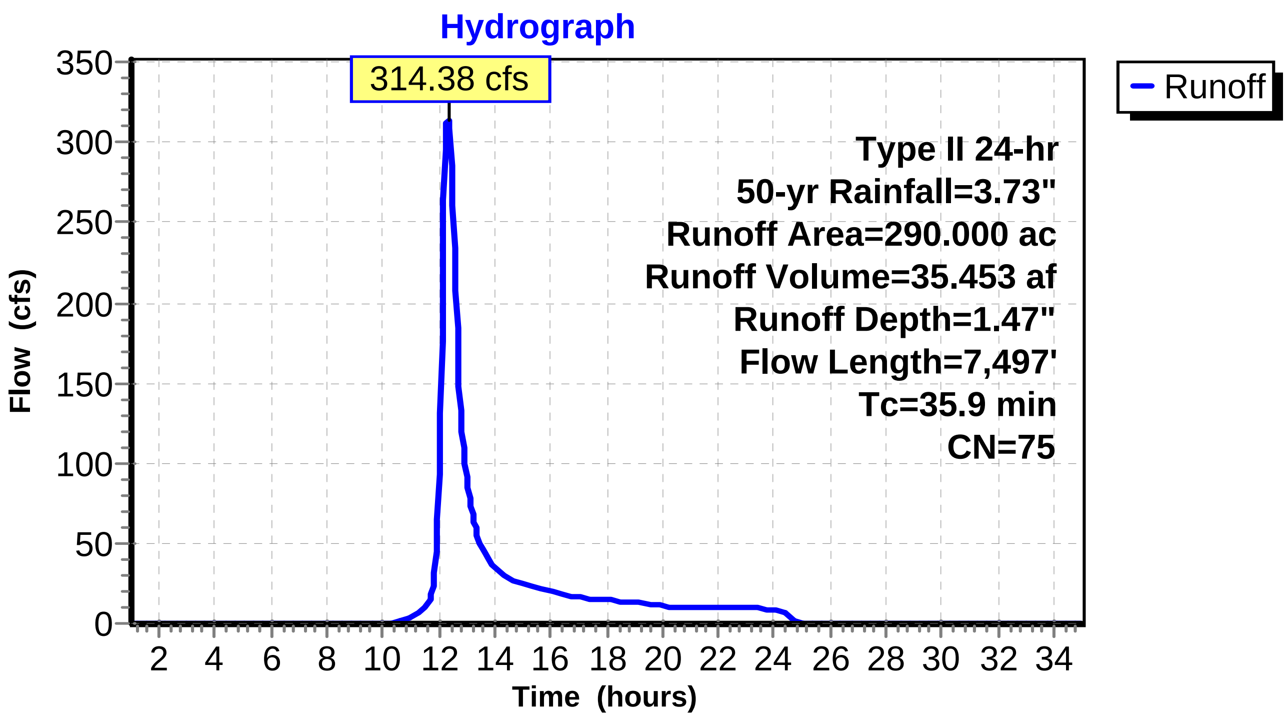
## Subcatchment EC: East Central



## Subcatchment W: West

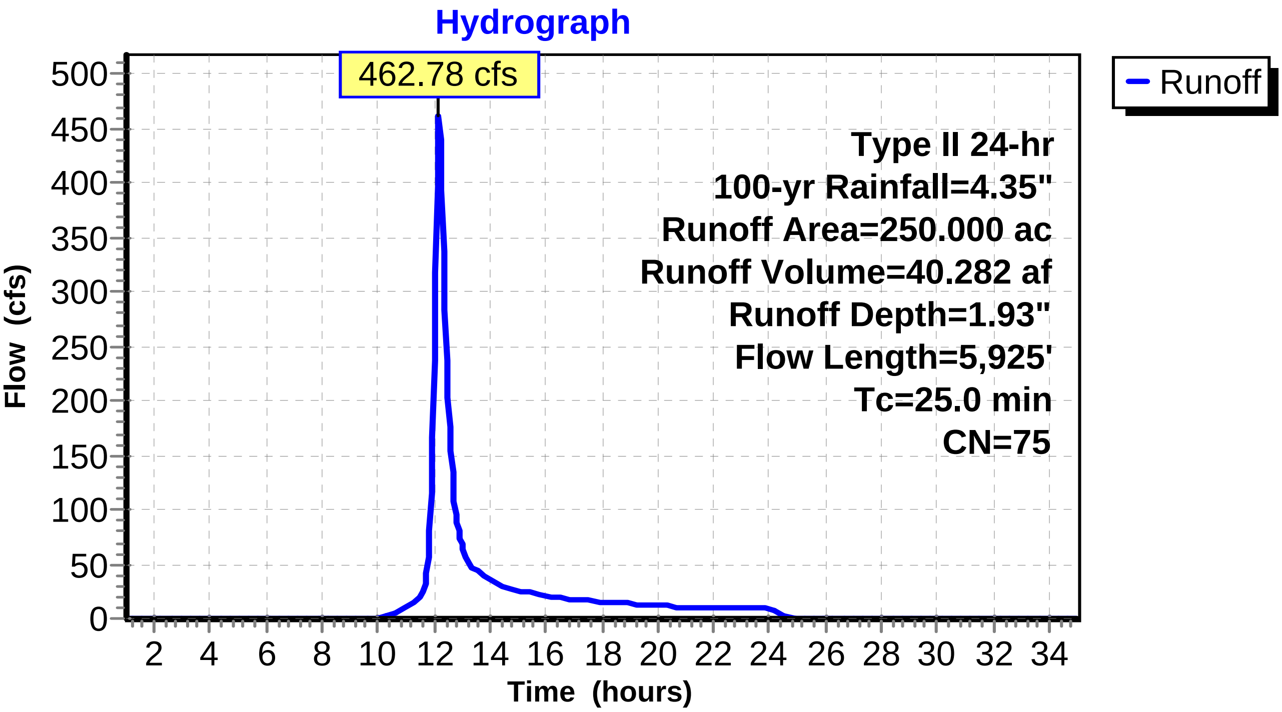


## Subcatchment WC: West Central

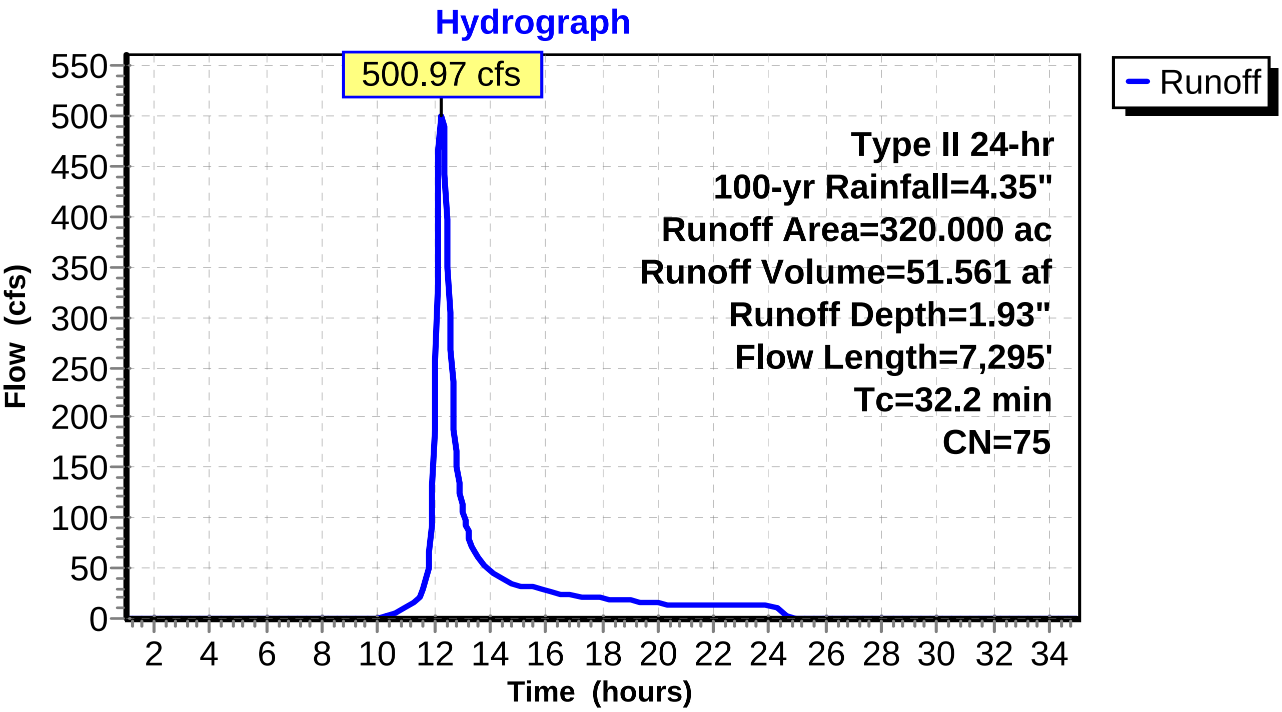


```
                          Time span=1.00-35.00 hrs, dt=0.05 hrs, 681 points
                          Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
              Reach routing by Stor-Ind+Trans method  -  Pond routing by Stor-Ind method

SubcatchmentE: East                                   Runoff Area=250.000 ac   Runoff Depth=1.93"
                          Flow Length=5,925'   Tc=25.0 min   CN=75   Runoff=462.78 cfs  40.282 af

SubcatchmentEC: East Central                          Runoff Area=320.000 ac   Runoff Depth=1.93"
                          Flow Length=7,295'   Tc=32.2 min   CN=75   Runoff=500.97 cfs  51.561 af

SubcatchmentW: West                                   Runoff Area=180.000 ac   Runoff Depth=1.93"
                          Flow Length=6,335'   Tc=36.1 min   CN=75   Runoff=260.62 cfs  29.003 af

SubcatchmentWC: West Central                          Runoff Area=290.000 ac   Runoff Depth=1.93"
                          Flow Length=7,497'   Tc=35.9 min   CN=75   Runoff=421.81 cfs  46.727 af

      Total Runoff Area = 1,040.000 ac   Runoff Volume = 167.573 af   Average Runoff Depth = 1.93"
```

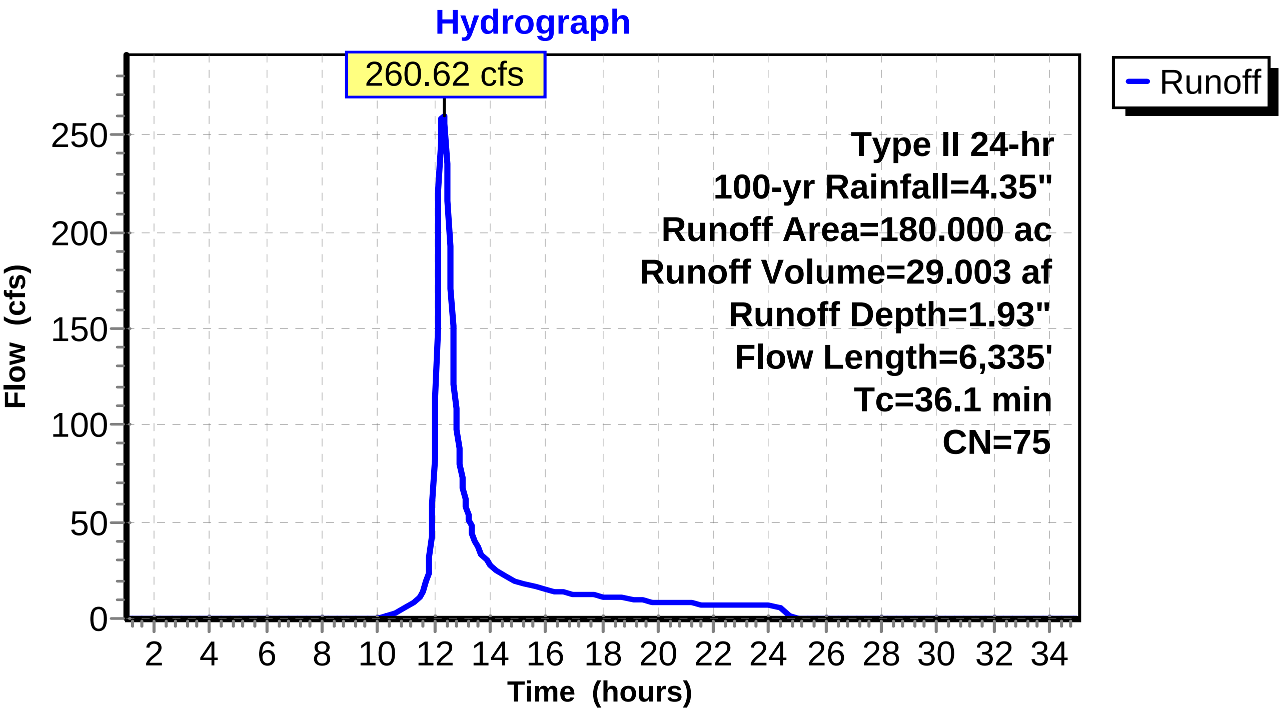
## Subcatchment E: East



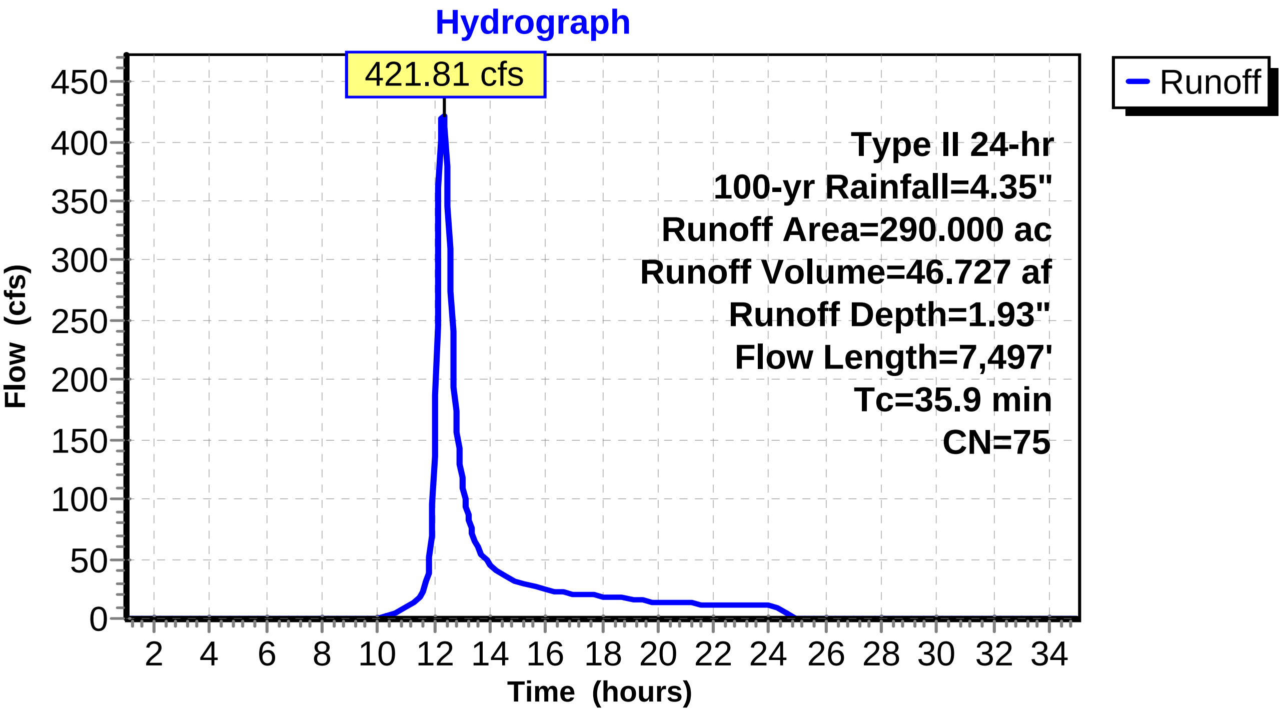
## Subcatchment EC: East Central

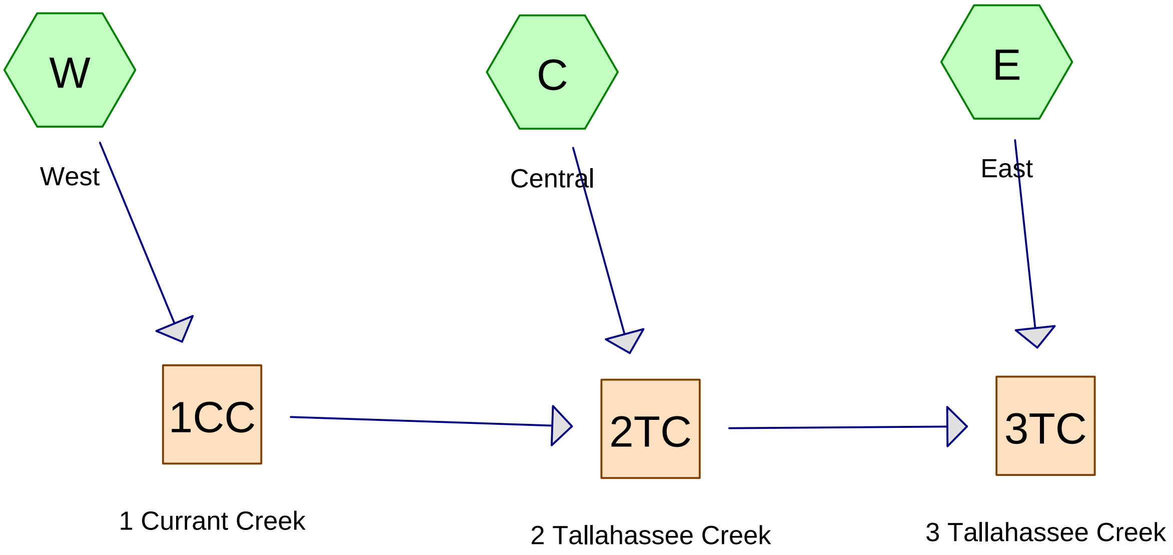


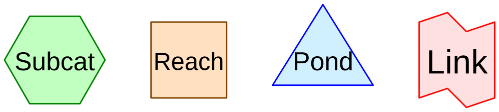
## Subcatchment W: West



## Subcatchment WC: West Central







**Routing Diagram for Parkdale_post_01**
Prepared by Whetstone Associates, Printed 1/15/2020
HydroCAD® 10.00 s/n 08184 © 2013 HydroCAD Software Solutions LLC

# Area Listing (all nodes)

| Area (acres) | CN | Description (subcatchment-numbers) |
|---:|---:|---|
| 1,040.000 | 89 | Herbaceous range, Fair, HSG D (C, E, W) |
| **1,040.000** | **89** | **TOTAL AREA** |

## Soil Listing (all nodes)

| Area (acres) | Soil Group | Subcatchment Numbers |
|---|---|---|
| 0.000 | HSG A | |
| 0.000 | HSG B | |
| 0.000 | HSG C | |
| 1,040.000 | HSG D | C, E, W |
| 0.000 | Other | |
| **1,040.000** | | **TOTAL AREA** |

## Ground Covers (all nodes)

| HSG-A (acres) | HSG-B (acres) | HSG-C (acres) | HSG-D (acres) | Other (acres) | Total (acres) | Ground Cover | Subcatchment Numbers |
|---|---|---|---|---|---|---|---|
| 0.000 | 0.000 | 0.000 | 1,040.000 | 0.000 | 1,040.000 | Herbaceous range, Fair | C, E, W |
| **0.000** | **0.000** | **0.000** | **1,040.000** | **0.000** | **1,040.000** | **TOTAL AREA** | |

Time span=1.00-30.00 hrs, dt=0.05 hrs, 581 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment C: Central** Runoff Area=400.000 ac Runoff Depth=0.78"
Flow Length=7,645' Tc=70.0 min CN=89 Runoff=145.04 cfs 25.904 af

**Subcatchment E: East** Runoff Area=405.000 ac Runoff Depth=0.78"
Flow Length=6,058' Tc=22.0 min CN=89 Runoff=327.39 cfs 26.228 af

**Subcatchment W: West** Runoff Area=235.000 ac Runoff Depth=0.78"
Flow Length=5,020' Tc=18.8 min CN=89 Runoff=208.05 cfs 15.218 af

**Total Runoff Area = 1,040.000 ac Runoff Volume = 67.350 af Average Runoff Depth = 0.78"**

## Summary for Subcatchment C: Central

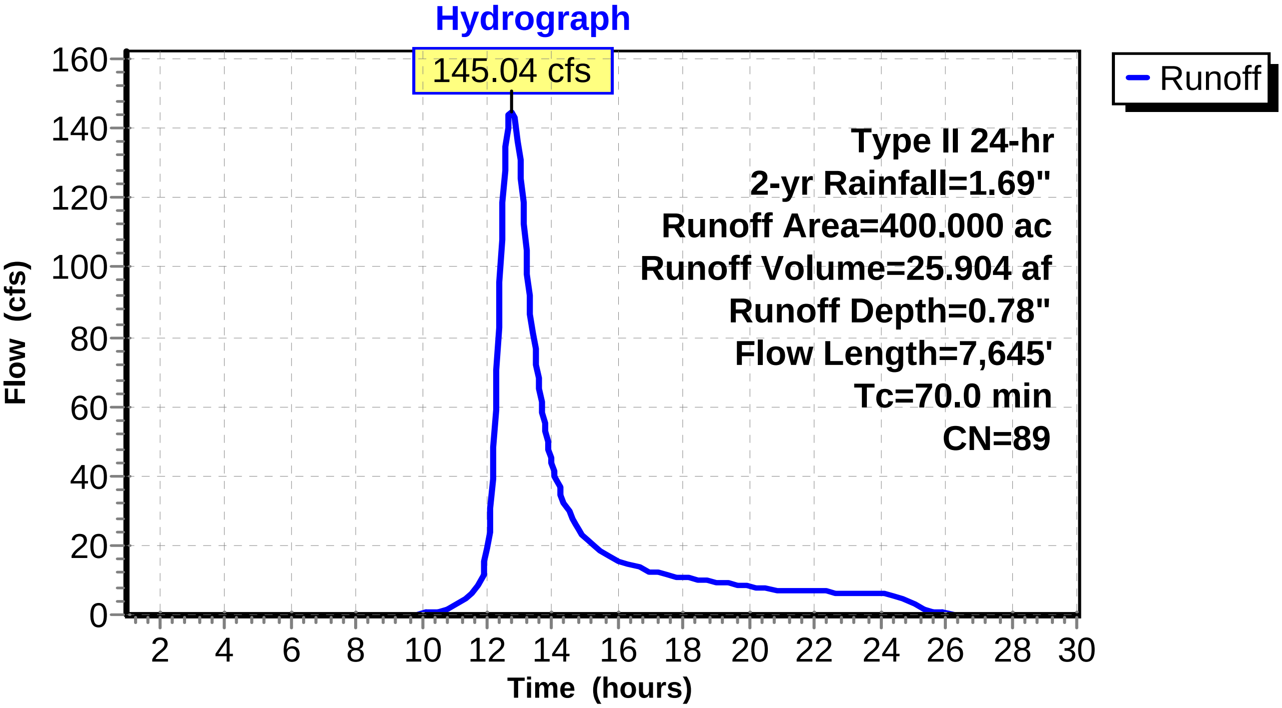
Runoff = 145.04 cfs @ 12.78 hrs, Volume= 25.904 af, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=1.69"

| Area (ac) | CN | Description |
|---|---|---|
| 400.000 | 89 | Herbaceous range, Fair, HSG D |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 0.2 | 40 | 0.5300 | 3.09 | | **Sheet Flow, Sheet Flow**<br>Smooth surfaces n= 0.011 P2= 1.69" |
| 1.1 | 775 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated Flow**<br>Unpaved Kv= 16.1 fps |
| 61.0 | 5,310 | 0.0169 | 1.45 | 2.18 | **Channel Flow, Reclaimed channel Central**<br>Area= 1.5 sf Perim= 4.2' r= 0.36' n= 0.067 |
| 7.7 | 1,520 | 0.0888 | 3.28 | 4.91 | **Channel Flow, Channel outside pit Central**<br>Area= 1.5 sf Perim= 4.3' r= 0.35' n= 0.067 |
| 70.0 | 7,645 | Total | | | |

### Subcatchment C: Central



## Summary for Subcatchment E: East

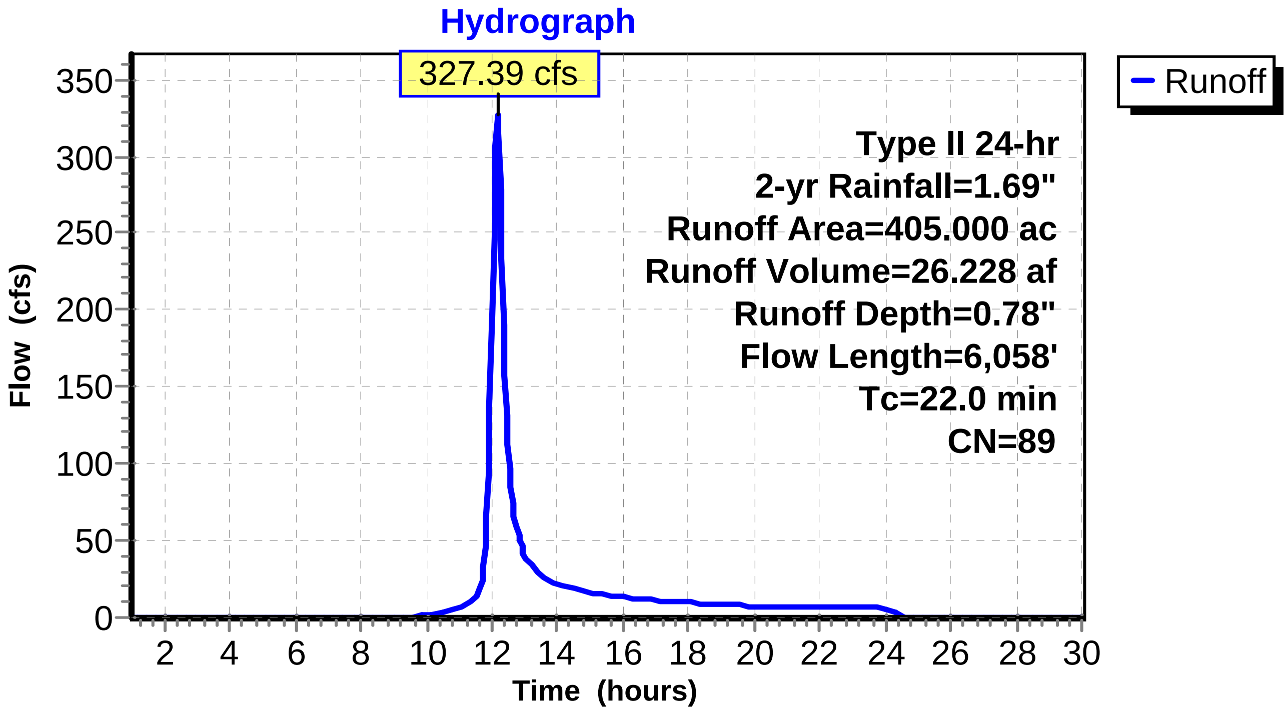
Runoff = 327.39 cfs @ 12.16 hrs, Volume= 26.228 af, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=1.69"

| Area (ac) | CN | Description |
|---|---|---|
| 405.000 | 89 | Herbaceous range, Fair, HSG D |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 1.6 | 40 | 0.5300 | 0.43 | | **Sheet Flow, Sheet Flow**<br>Range n= 0.130 P2= 1.69" |
| 1.0 | 708 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated**<br>Unpaved Kv= 16.1 fps |
| 14.0 | 3,820 | 0.0196 | 4.55 | 6.83 | **Channel Flow, Reclaimed Channel within Pit East**<br>Area= 1.5 sf Perim= 4.2' r= 0.36'<br>n= 0.023 Earth, clean & winding |
| 5.4 | 1,490 | 0.1711 | 4.62 | 6.93 | **Channel Flow, Channel outside pit - East**<br>Area= 1.5 sf Perim= 4.2' r= 0.36' n= 0.067 |
| 22.0 | 6,058 | Total | | | |

### Subcatchment E: East



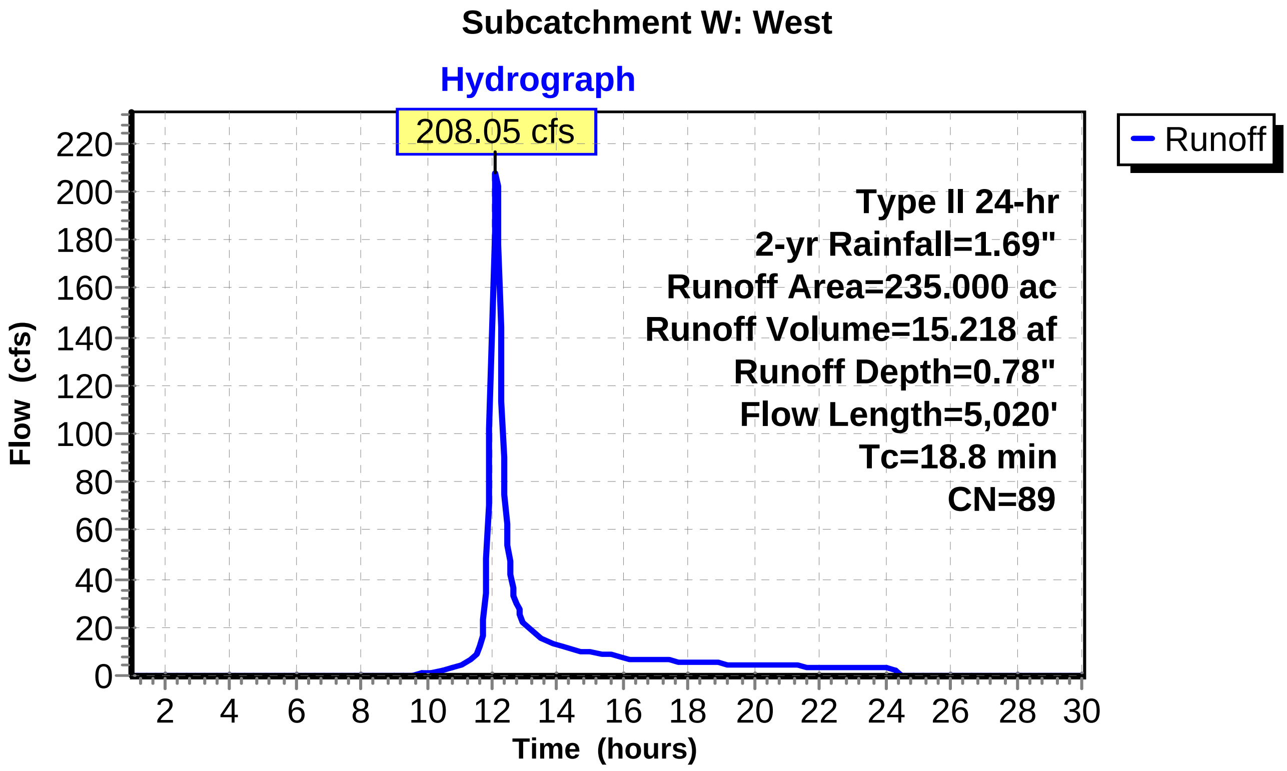
## Summary for Subcatchment W: West

Runoff = 208.05 cfs @ 12.12 hrs, Volume= 15.218 af, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-yr Rainfall=1.69"

| Area (ac) | CN | Description |
|---|---|---|
| 235.000 | 89 | Herbaceous range, Fair, HSG D |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 0.2 | 40 | 0.5300 | 3.09 | | **Sheet Flow, Sheet Flow**<br>Smooth surfaces n= 0.011 P2= 1.69" |
| 0.9 | 650 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated**<br>Unpaved Kv= 16.1 fps |
| 13.5 | 3,560 | 0.0183 | 4.40 | 6.60 | **Channel Flow, Reclaimed Channel West**<br>Area= 1.5 sf Perim= 4.2' r= 0.36'<br>n= 0.023 Earth, clean & winding |
| 4.2 | 770 | 0.0779 | 3.07 | 4.60 | **Channel Flow, Outside pit channel**<br>Area= 1.5 sf Perim= 4.3' r= 0.35' n= 0.067 |
| 18.8 | 5,020 | Total | | | |



```
                    Time span=1.00-30.00 hrs, dt=0.05 hrs, 581 points
                    Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
      Reach routing by Stor-Ind+Trans method  -  Pond routing by Stor-Ind method

SubcatchmentC: Central                        Runoff Area=400.000 ac   Runoff Depth=1.13"
                      Flow Length=7,645'   Tc=70.0 min   CN=89   Runoff=213.82 cfs  37.608 af

SubcatchmentE: East                           Runoff Area=405.000 ac   Runoff Depth=1.13"
                      Flow Length=6,058'   Tc=22.0 min   CN=89   Runoff=479.01 cfs  38.078 af

SubcatchmentW: West                           Runoff Area=235.000 ac   Runoff Depth=1.13"
                      Flow Length=5,020'   Tc=18.8 min   CN=89   Runoff=303.91 cfs  22.095 af

    Total Runoff Area = 1,040.000 ac   Runoff Volume = 97.780 af   Average Runoff Depth = 1.13"
```

## Summary for Subcatchment C: Central

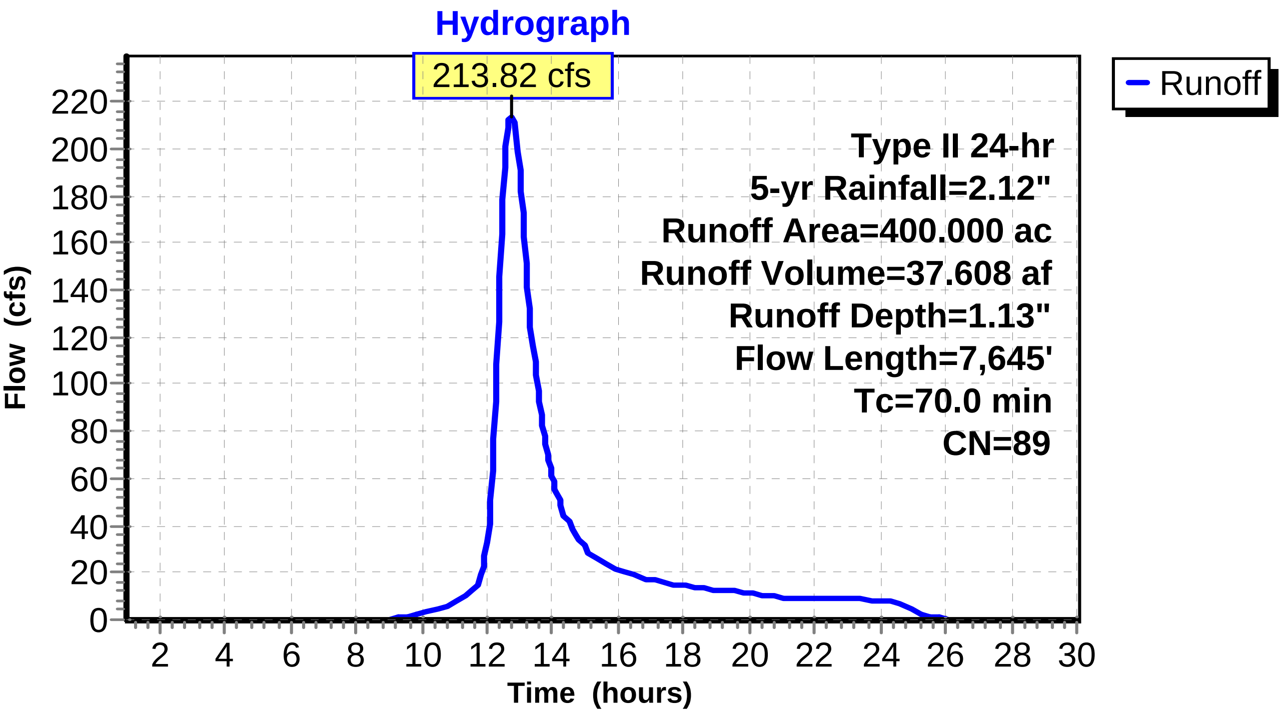
Runoff = 213.82 cfs @ 12.76 hrs, Volume= 37.608 af, Depth= 1.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 5-yr Rainfall=2.12"

| Area (ac) | CN | Description |
|---|---|---|
| 400.000 | 89 | Herbaceous range, Fair, HSG D |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 0.2 | 40 | 0.5300 | 3.09 | | **Sheet Flow, Sheet Flow**<br>Smooth surfaces n= 0.011 P2= 1.69" |
| 1.1 | 775 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated Flow**<br>Unpaved Kv= 16.1 fps |
| 61.0 | 5,310 | 0.0169 | 1.45 | 2.18 | **Channel Flow, Reclaimed channel Central**<br>Area= 1.5 sf Perim= 4.2' r= 0.36' n= 0.067 |
| 7.7 | 1,520 | 0.0888 | 3.28 | 4.91 | **Channel Flow, Channel outside pit Central**<br>Area= 1.5 sf Perim= 4.3' r= 0.35' n= 0.067 |
| 70.0 | 7,645 | Total | | | |

### Subcatchment C: Central



## Summary for Subcatchment E: East

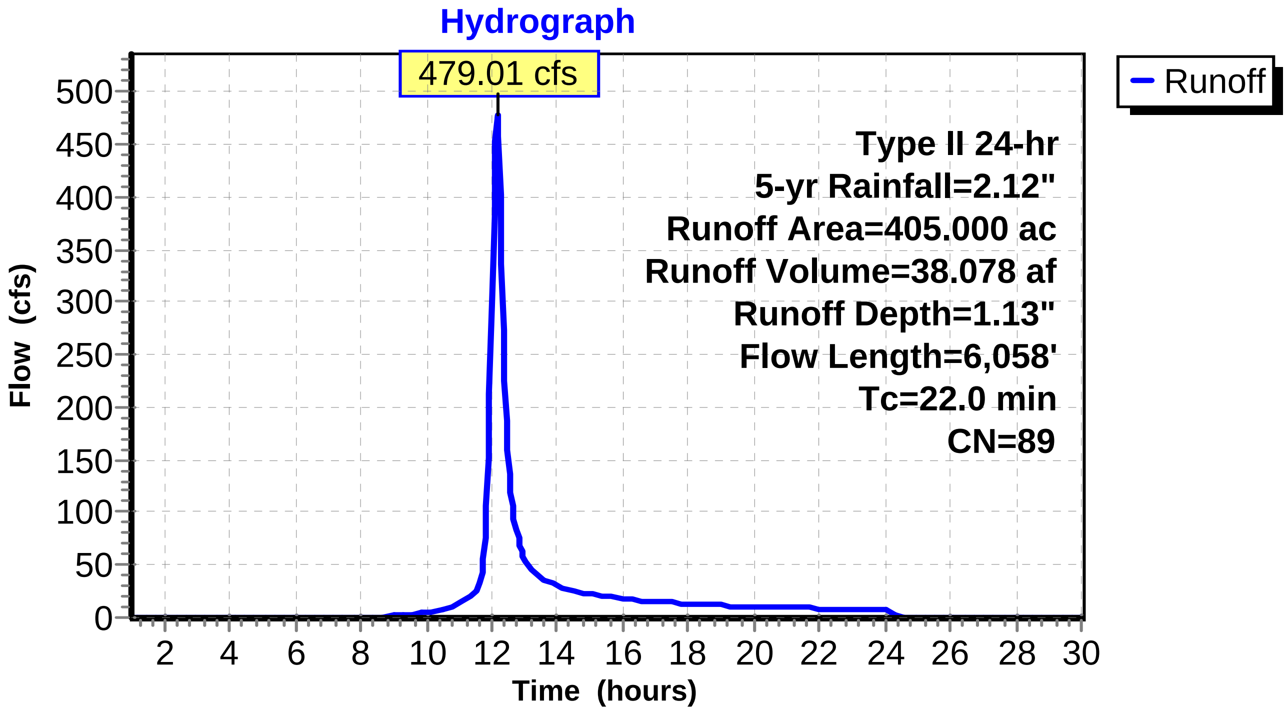
Runoff = 479.01 cfs @ 12.15 hrs, Volume= 38.078 af, Depth= 1.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 5-yr Rainfall=2.12"

| Area (ac) | CN | Description |
|---|---|---|
| 405.000 | 89 | Herbaceous range, Fair, HSG D |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 1.6 | 40 | 0.5300 | 0.43 | | **Sheet Flow, Sheet Flow**<br>Range n= 0.130 P2= 1.69" |
| 1.0 | 708 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated**<br>Unpaved Kv= 16.1 fps |
| 14.0 | 3,820 | 0.0196 | 4.55 | 6.83 | **Channel Flow, Reclaimed Channel within Pit East**<br>Area= 1.5 sf Perim= 4.2' r= 0.36'<br>n= 0.023 Earth, clean & winding |
| 5.4 | 1,490 | 0.1711 | 4.62 | 6.93 | **Channel Flow, Channel outside pit - East**<br>Area= 1.5 sf Perim= 4.2' r= 0.36' n= 0.067 |
| 22.0 | 6,058 | Total | | | |

### Subcatchment E: East



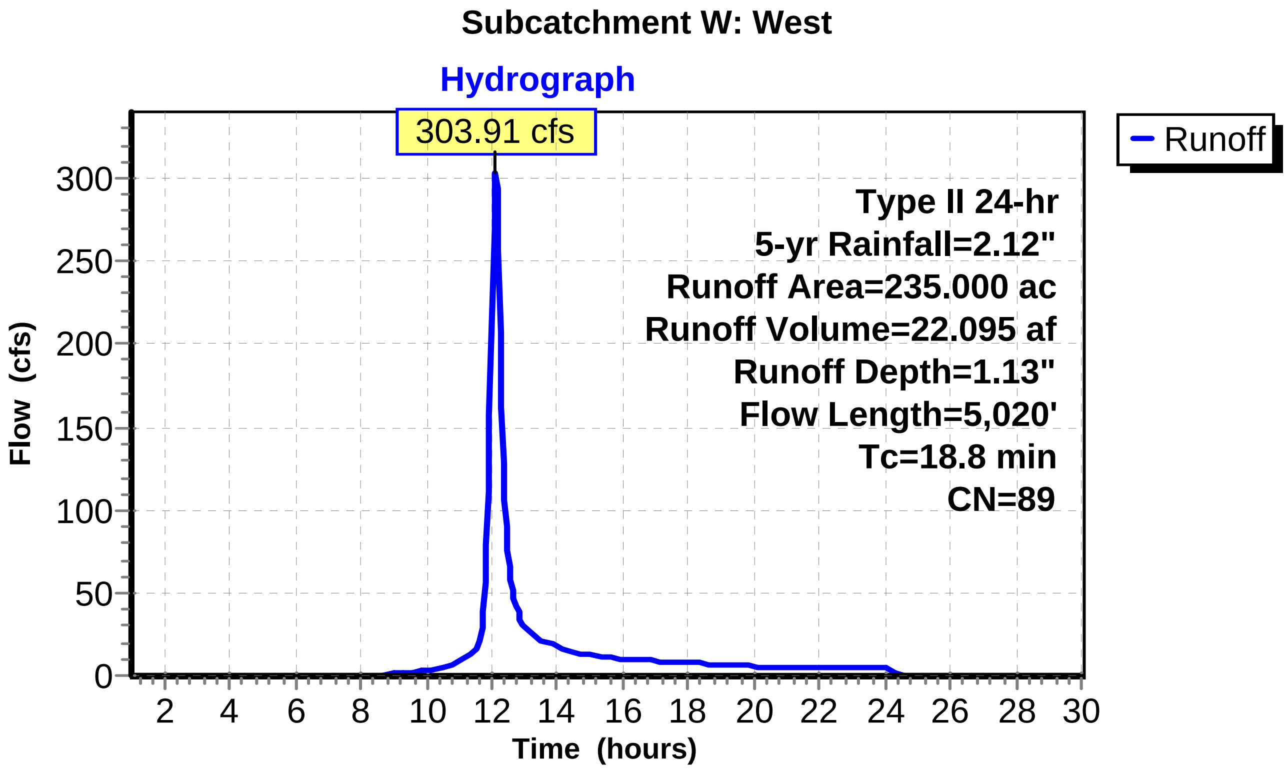
## Summary for Subcatchment W: West

Runoff = 303.91 cfs @ 12.11 hrs, Volume= 22.095 af, Depth= 1.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 5-yr Rainfall=2.12"

| Area (ac) | CN | Description |
|---|---|---|
| 235.000 | 89 | Herbaceous range, Fair, HSG D |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 0.2 | 40 | 0.5300 | 3.09 | | **Sheet Flow, Sheet Flow**<br>Smooth surfaces n= 0.011 P2= 1.69" |
| 0.9 | 650 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated**<br>Unpaved Kv= 16.1 fps |
| 13.5 | 3,560 | 0.0183 | 4.40 | 6.60 | **Channel Flow, Reclaimed Channel West**<br>Area= 1.5 sf Perim= 4.2' r= 0.36'<br>n= 0.023 Earth, clean & winding |
| 4.2 | 770 | 0.0779 | 3.07 | 4.60 | **Channel Flow, Outside pit channel**<br>Area= 1.5 sf Perim= 4.3' r= 0.35' n= 0.067 |
| 18.8 | 5,020 | Total | | | |



Time span=1.00-30.00 hrs, dt=0.05 hrs, 581 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment C: Central** Runoff Area=400.000 ac Runoff Depth=1.47"
Flow Length=7,645' Tc=70.0 min CN=89 Runoff=280.65 cfs 49.074 af

**Subcatchment E: East** Runoff Area=405.000 ac Runoff Depth=1.47"
Flow Length=6,058' Tc=22.0 min CN=89 Runoff=625.41 cfs 49.687 af

**Subcatchment W: West** Runoff Area=235.000 ac Runoff Depth=1.47"
Flow Length=5,020' Tc=18.8 min CN=89 Runoff=396.39 cfs 28.831 af

**Total Runoff Area = 1,040.000 ac Runoff Volume = 127.592 af Average Runoff Depth = 1.47"**

## Summary for Subcatchment C: Central

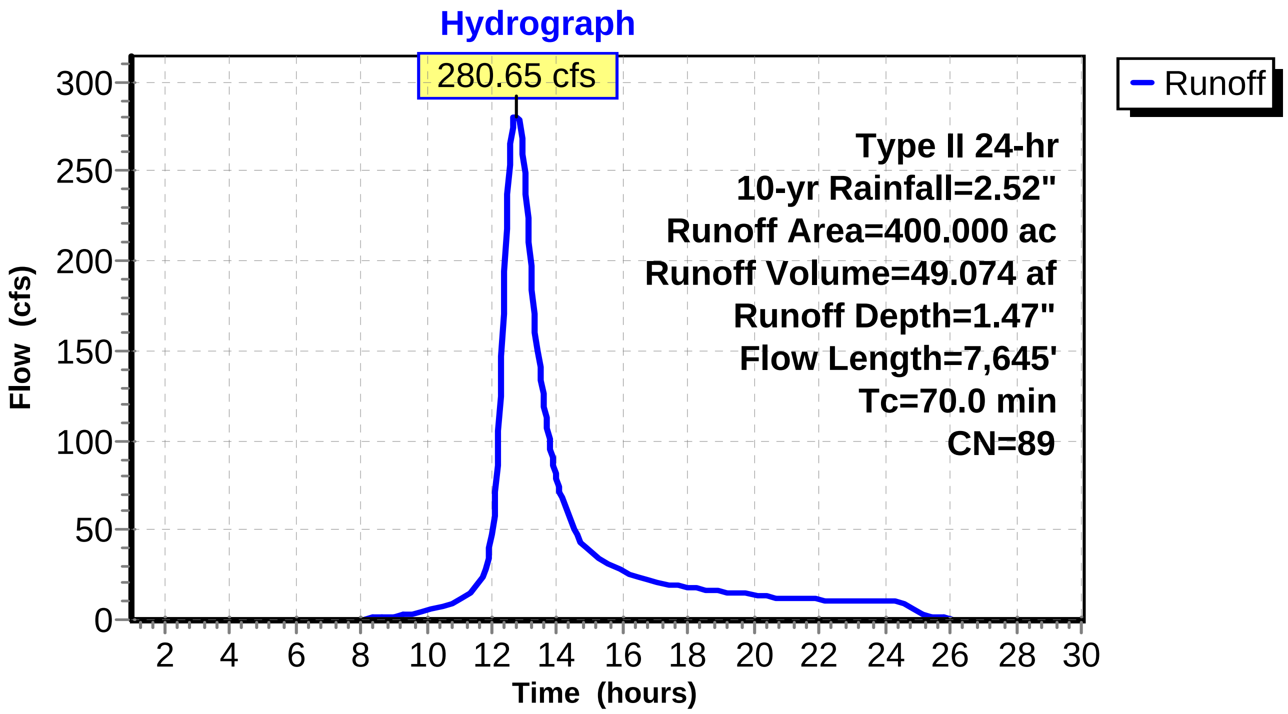
Runoff = 280.65 cfs @ 12.75 hrs, Volume= 49.074 af, Depth= 1.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=2.52"

| Area (ac) | CN | Description |
|---|---|---|
| 400.000 | 89 | Herbaceous range, Fair, HSG D |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 0.2 | 40 | 0.5300 | 3.09 | | **Sheet Flow, Sheet Flow**<br>Smooth surfaces n= 0.011 P2= 1.69" |
| 1.1 | 775 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated Flow**<br>Unpaved Kv= 16.1 fps |
| 61.0 | 5,310 | 0.0169 | 1.45 | 2.18 | **Channel Flow, Reclaimed channel Central**<br>Area= 1.5 sf Perim= 4.2' r= 0.36' n= 0.067 |
| 7.7 | 1,520 | 0.0888 | 3.28 | 4.91 | **Channel Flow, Channel outside pit Central**<br>Area= 1.5 sf Perim= 4.3' r= 0.35' n= 0.067 |
| 70.0 | 7,645 | Total | | | |

### Subcatchment C: Central



## Summary for Subcatchment E: East

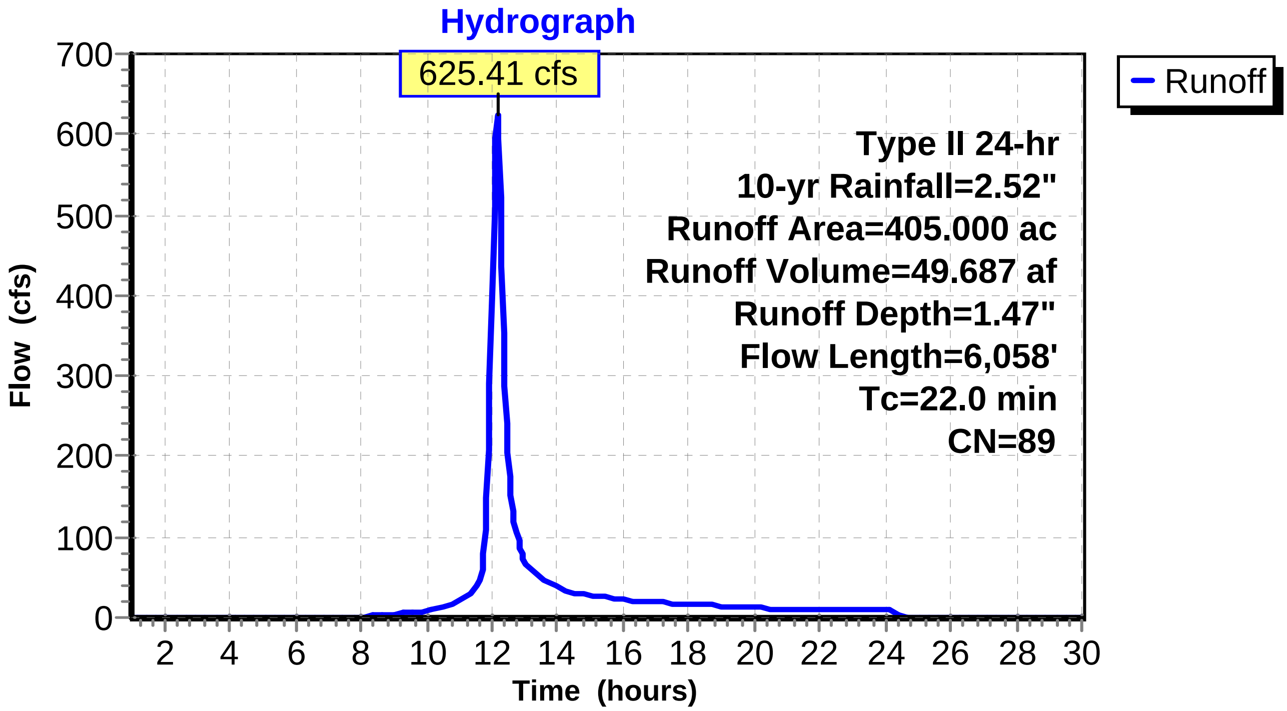
Runoff = 625.41 cfs @ 12.15 hrs, Volume= 49.687 af, Depth= 1.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=2.52"

| Area (ac) | CN | Description |
|---|---|---|
| 405.000 | 89 | Herbaceous range, Fair, HSG D |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 1.6 | 40 | 0.5300 | 0.43 | | **Sheet Flow, Sheet Flow**<br>Range n= 0.130 P2= 1.69" |
| 1.0 | 708 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated**<br>Unpaved Kv= 16.1 fps |
| 14.0 | 3,820 | 0.0196 | 4.55 | 6.83 | **Channel Flow, Reclaimed Channel within Pit East**<br>Area= 1.5 sf Perim= 4.2' r= 0.36'<br>n= 0.023 Earth, clean & winding |
| 5.4 | 1,490 | 0.1711 | 4.62 | 6.93 | **Channel Flow, Channel outside pit - East**<br>Area= 1.5 sf Perim= 4.2' r= 0.36' n= 0.067 |
| 22.0 | 6,058 | Total | | | |

### Subcatchment E: East



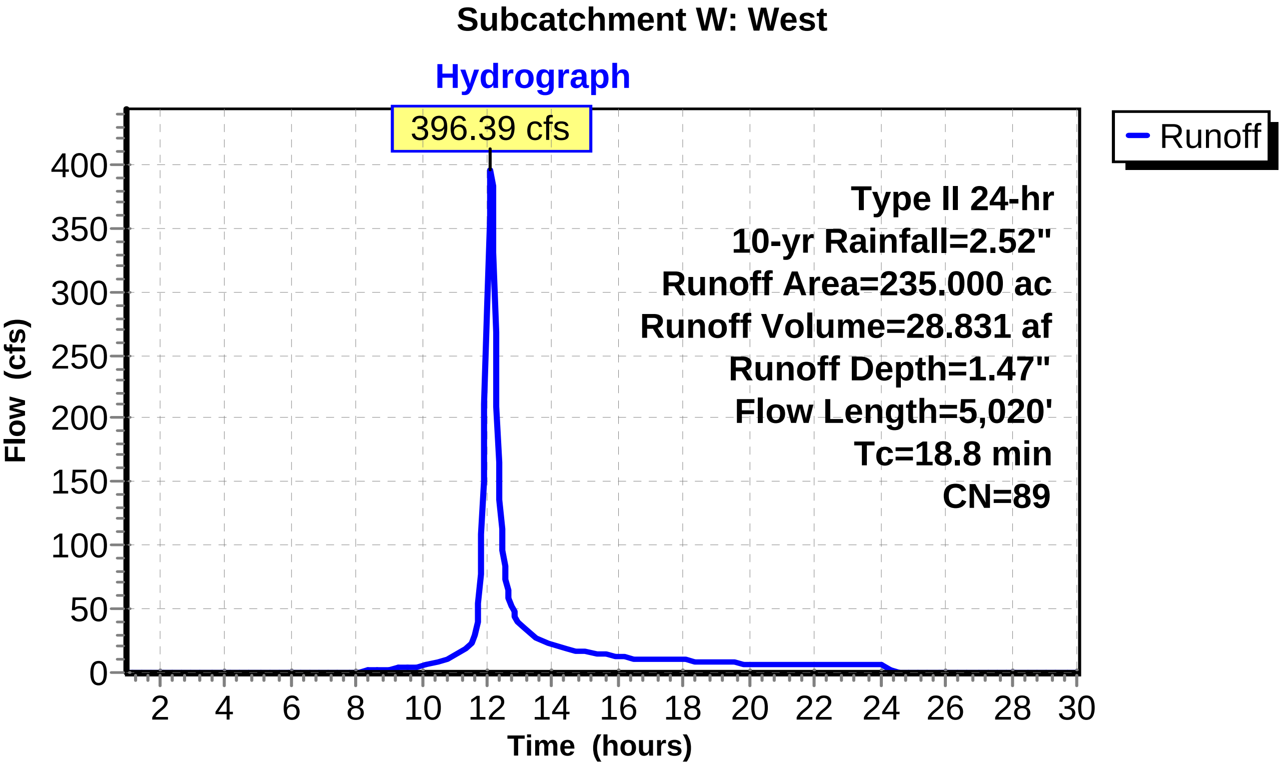
## Summary for Subcatchment W: West

Runoff = 396.39 cfs @ 12.11 hrs, Volume= 28.831 af, Depth= 1.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-yr Rainfall=2.52"

| Area (ac) | CN | Description |
|---|---|---|
| 235.000 | 89 | Herbaceous range, Fair, HSG D |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 0.2 | 40 | 0.5300 | 3.09 | | **Sheet Flow, Sheet Flow**<br>Smooth surfaces n= 0.011 P2= 1.69" |
| 0.9 | 650 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated**<br>Unpaved Kv= 16.1 fps |
| 13.5 | 3,560 | 0.0183 | 4.40 | 6.60 | **Channel Flow, Reclaimed Channel West**<br>Area= 1.5 sf Perim= 4.2' r= 0.36'<br>n= 0.023 Earth, clean & winding |
| 4.2 | 770 | 0.0779 | 3.07 | 4.60 | **Channel Flow, Outside pit channel**<br>Area= 1.5 sf Perim= 4.3' r= 0.35' n= 0.067 |
| 18.8 | 5,020 | Total | | | |



Time span=1.00-30.00 hrs, dt=0.05 hrs, 581 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment C: Central** Runoff Area=400.000 ac Runoff Depth=2.05"
Flow Length=7,645' Tc=70.0 min CN=89 Runoff=392.39 cfs 68.472 af

**Subcatchment E: East** Runoff Area=405.000 ac Runoff Depth=2.05"
Flow Length=6,058' Tc=22.0 min CN=89 Runoff=868.87 cfs 69.328 af

**Subcatchment W: West** Runoff Area=235.000 ac Runoff Depth=2.05"
Flow Length=5,020' Tc=18.8 min CN=89 Runoff=550.07 cfs 40.228 af

**Total Runoff Area = 1,040.000 ac Runoff Volume = 178.028 af Average Runoff Depth = 2.05"**

## Summary for Subcatchment C: Central

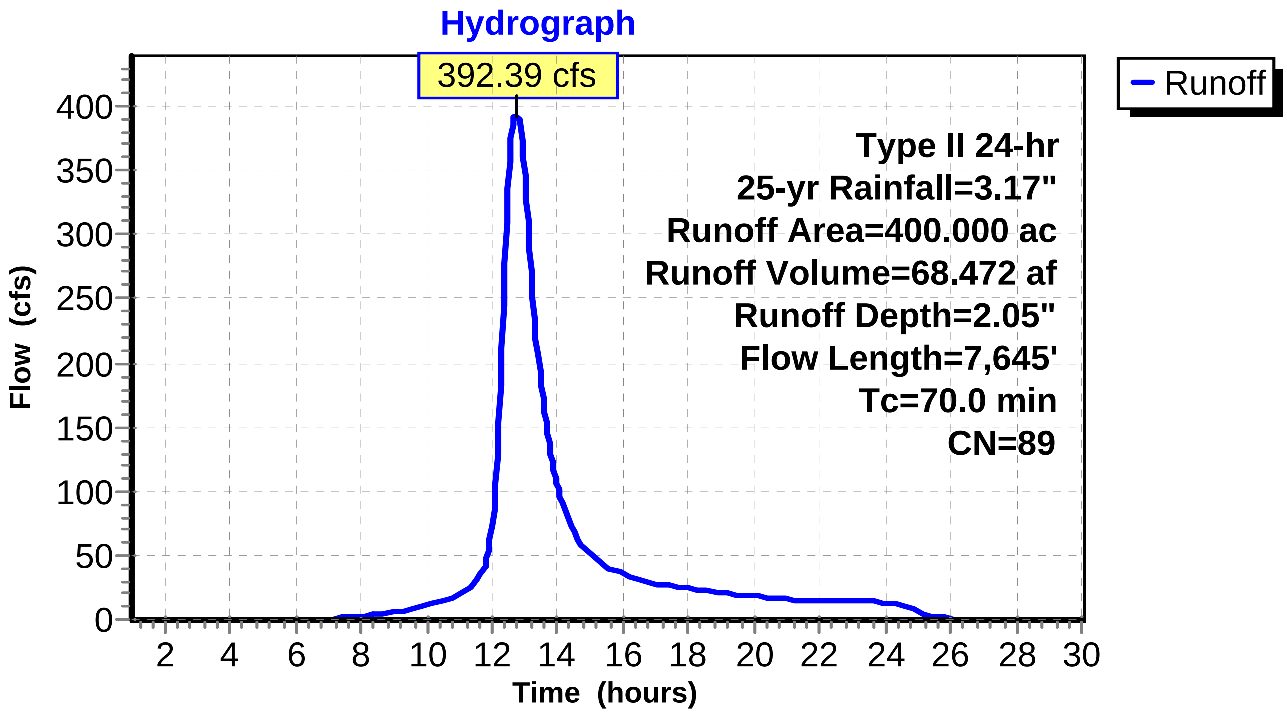
Runoff = 392.39 cfs @ 12.73 hrs, Volume= 68.472 af, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=3.17"

| Area (ac) | CN | Description |
|---|---|---|
| 400.000 | 89 | Herbaceous range, Fair, HSG D |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 0.2 | 40 | 0.5300 | 3.09 | | **Sheet Flow, Sheet Flow**<br>Smooth surfaces n= 0.011 P2= 1.69" |
| 1.1 | 775 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated Flow**<br>Unpaved Kv= 16.1 fps |
| 61.0 | 5,310 | 0.0169 | 1.45 | 2.18 | **Channel Flow, Reclaimed channel Central**<br>Area= 1.5 sf Perim= 4.2' r= 0.36' n= 0.067 |
| 7.7 | 1,520 | 0.0888 | 3.28 | 4.91 | **Channel Flow, Channel outside pit Central**<br>Area= 1.5 sf Perim= 4.3' r= 0.35' n= 0.067 |
| 70.0 | 7,645 | Total | | | |

### Subcatchment C: Central



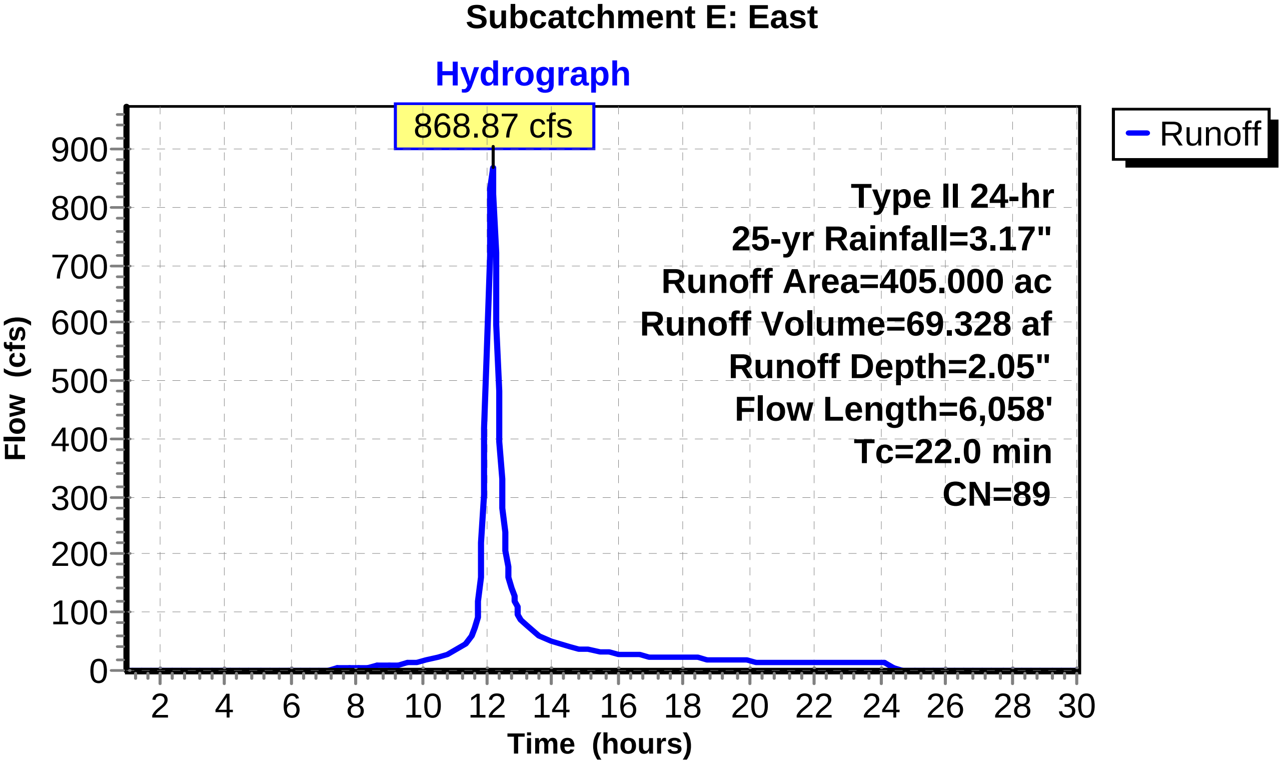
## Summary for Subcatchment E: East

Runoff = 868.87 cfs @ 12.15 hrs, Volume= 69.328 af, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=3.17"

| Area (ac) | CN | Description |
|---|---|---|
| 405.000 | 89 | Herbaceous range, Fair, HSG D |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 1.6 | 40 | 0.5300 | 0.43 | | **Sheet Flow, Sheet Flow**<br>Range n= 0.130 P2= 1.69" |
| 1.0 | 708 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated**<br>Unpaved Kv= 16.1 fps |
| 14.0 | 3,820 | 0.0196 | 4.55 | 6.83 | **Channel Flow, Reclaimed Channel within Pit East**<br>Area= 1.5 sf Perim= 4.2' r= 0.36'<br>n= 0.023 Earth, clean & winding |
| 5.4 | 1,490 | 0.1711 | 4.62 | 6.93 | **Channel Flow, Channel outside pit - East**<br>Area= 1.5 sf Perim= 4.2' r= 0.36' n= 0.067 |
| 22.0 | 6,058 | Total | | | |



## Summary for Subcatchment W: West

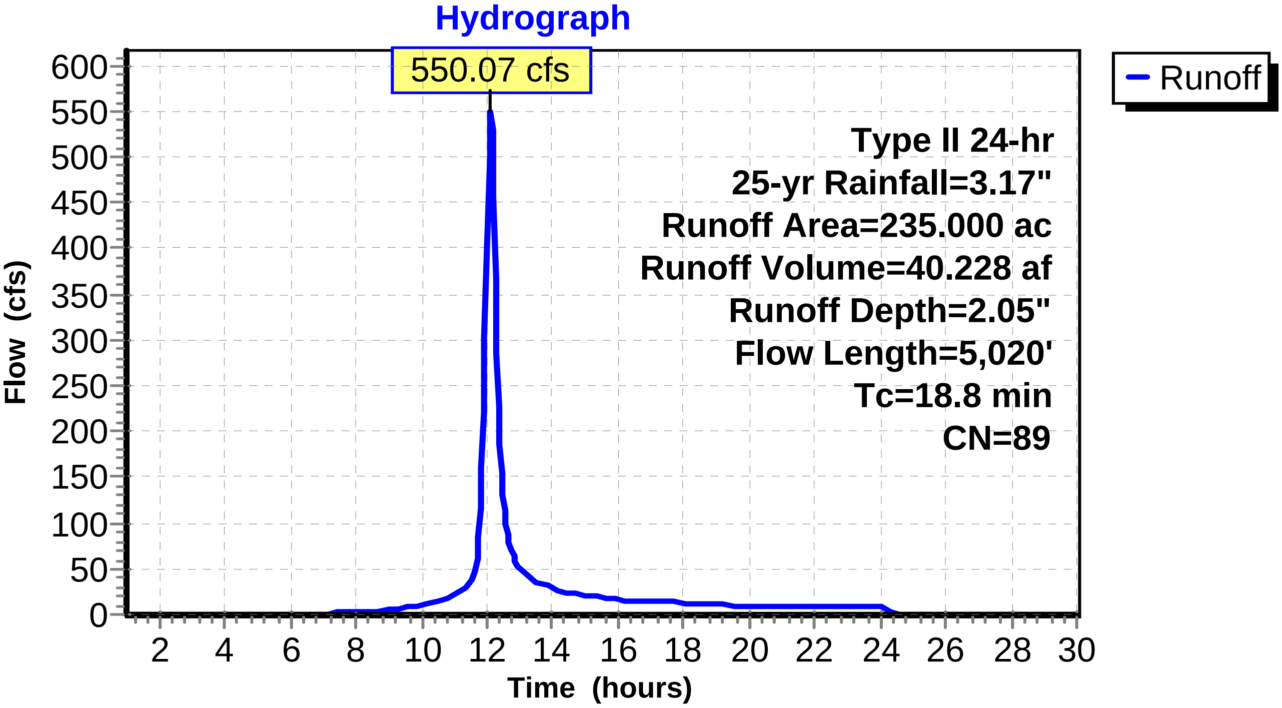
Runoff = 550.07 cfs @ 12.11 hrs, Volume= 40.228 af, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 25-yr Rainfall=3.17"

| Area (ac) | CN | Description |
|---|---|---|
| 235.000 | 89 | Herbaceous range, Fair, HSG D |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 0.2 | 40 | 0.5300 | 3.09 | | **Sheet Flow, Sheet Flow**<br>Smooth surfaces n= 0.011 P2= 1.69" |
| 0.9 | 650 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated**<br>Unpaved Kv= 16.1 fps |
| 13.5 | 3,560 | 0.0183 | 4.40 | 6.60 | **Channel Flow, Reclaimed Channel West**<br>Area= 1.5 sf Perim= 4.2' r= 0.36'<br>n= 0.023 Earth, clean & winding |
| 4.2 | 770 | 0.0779 | 3.07 | 4.60 | **Channel Flow, Outside pit channel**<br>Area= 1.5 sf Perim= 4.3' r= 0.35' n= 0.067 |
| 18.8 | 5,020 | Total | | | |

### Subcatchment W: West



Time span=1.00-30.00 hrs, dt=0.05 hrs, 581 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment C: Central** Runoff Area=400.000 ac Runoff Depth=2.57"
Flow Length=7,645' Tc=70.0 min CN=89 Runoff=490.24 cfs 85.686 af

**Subcatchment E: East** Runoff Area=405.000 ac Runoff Depth=2.57"
Flow Length=6,058' Tc=22.0 min CN=89 Runoff=1,081.12 cfs 86.757 af

**Subcatchment W: West** Runoff Area=235.000 ac Runoff Depth=2.57"
Flow Length=5,020' Tc=18.8 min CN=89 Runoff=683.96 cfs 50.341 af

**Total Runoff Area = 1,040.000 ac Runoff Volume = 222.784 af Average Runoff Depth = 2.57"**

## Summary for Subcatchment C: Central

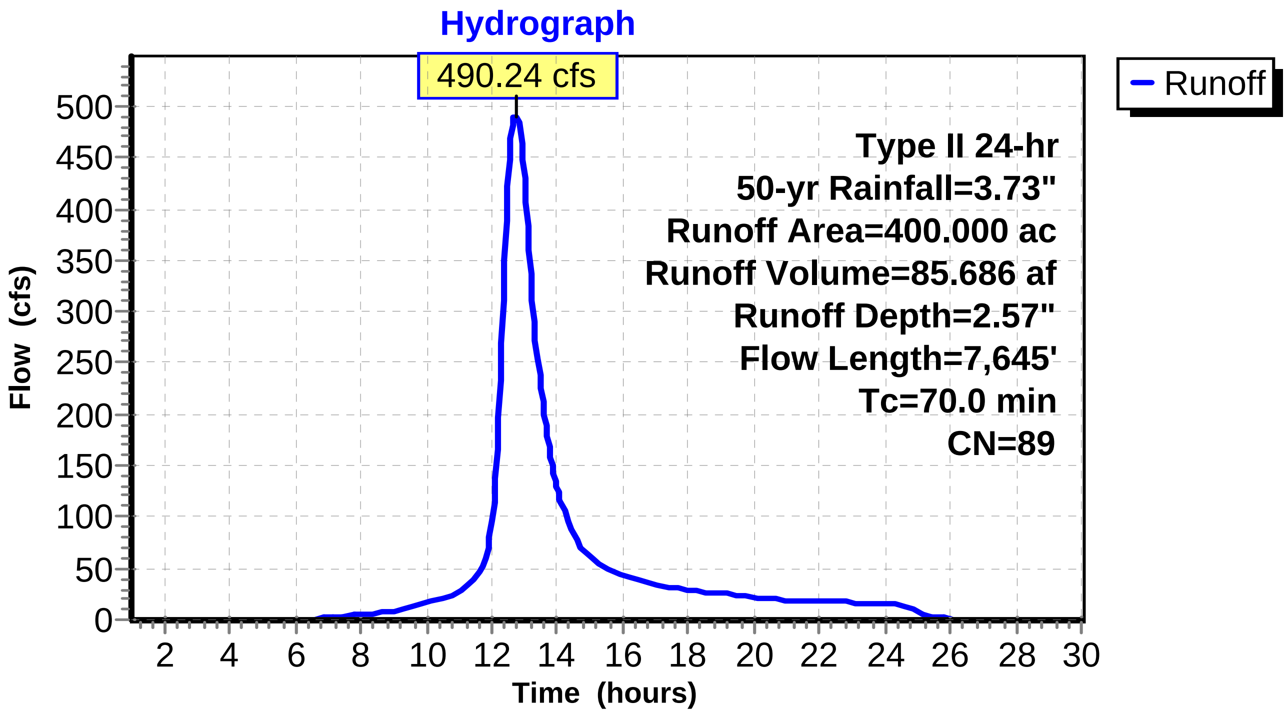
Runoff = 490.24 cfs @ 12.73 hrs, Volume= 85.686 af, Depth= 2.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=3.73"

| Area (ac) | CN | Description |
|---|---|---|
| 400.000 | 89 | Herbaceous range, Fair, HSG D |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 0.2 | 40 | 0.5300 | 3.09 | | **Sheet Flow, Sheet Flow**<br>Smooth surfaces n= 0.011 P2= 1.69" |
| 1.1 | 775 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated Flow**<br>Unpaved Kv= 16.1 fps |
| 61.0 | 5,310 | 0.0169 | 1.45 | 2.18 | **Channel Flow, Reclaimed channel Central**<br>Area= 1.5 sf Perim= 4.2' r= 0.36' n= 0.067 |
| 7.7 | 1,520 | 0.0888 | 3.28 | 4.91 | **Channel Flow, Channel outside pit Central**<br>Area= 1.5 sf Perim= 4.3' r= 0.35' n= 0.067 |
| 70.0 | 7,645 | Total | | | |

### Subcatchment C: Central



## Summary for Subcatchment E: East

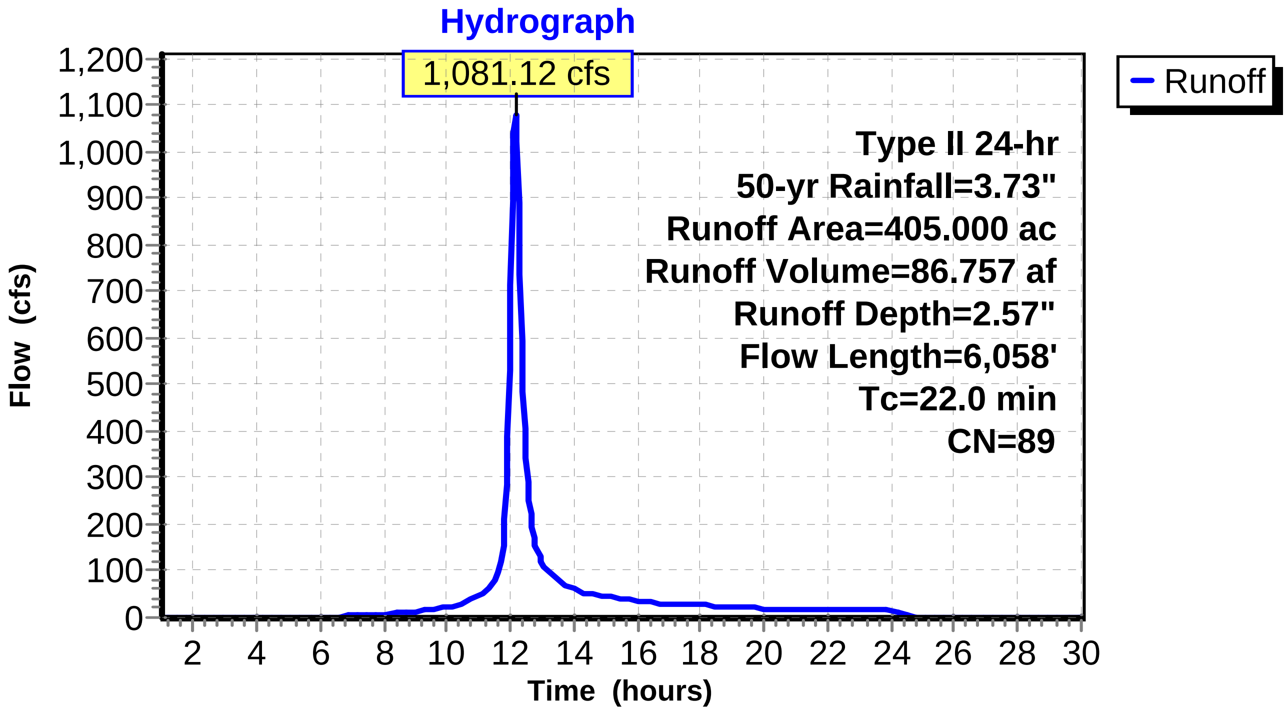
Runoff = 1,081.12 cfs @ 12.15 hrs, Volume= 86.757 af, Depth= 2.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=3.73"

| Area (ac) | CN | Description |
|---|---|---|
| 405.000 | 89 | Herbaceous range, Fair, HSG D |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 1.6 | 40 | 0.5300 | 0.43 | | **Sheet Flow, Sheet Flow**<br>Range n= 0.130 P2= 1.69" |
| 1.0 | 708 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated**<br>Unpaved Kv= 16.1 fps |
| 14.0 | 3,820 | 0.0196 | 4.55 | 6.83 | **Channel Flow, Reclaimed Channel within Pit East**<br>Area= 1.5 sf Perim= 4.2' r= 0.36'<br>n= 0.023 Earth, clean & winding |
| 5.4 | 1,490 | 0.1711 | 4.62 | 6.93 | **Channel Flow, Channel outside pit - East**<br>Area= 1.5 sf Perim= 4.2' r= 0.36' n= 0.067 |
| 22.0 | 6,058 | Total | | | |

### Subcatchment E: East



## Summary for Subcatchment W: West

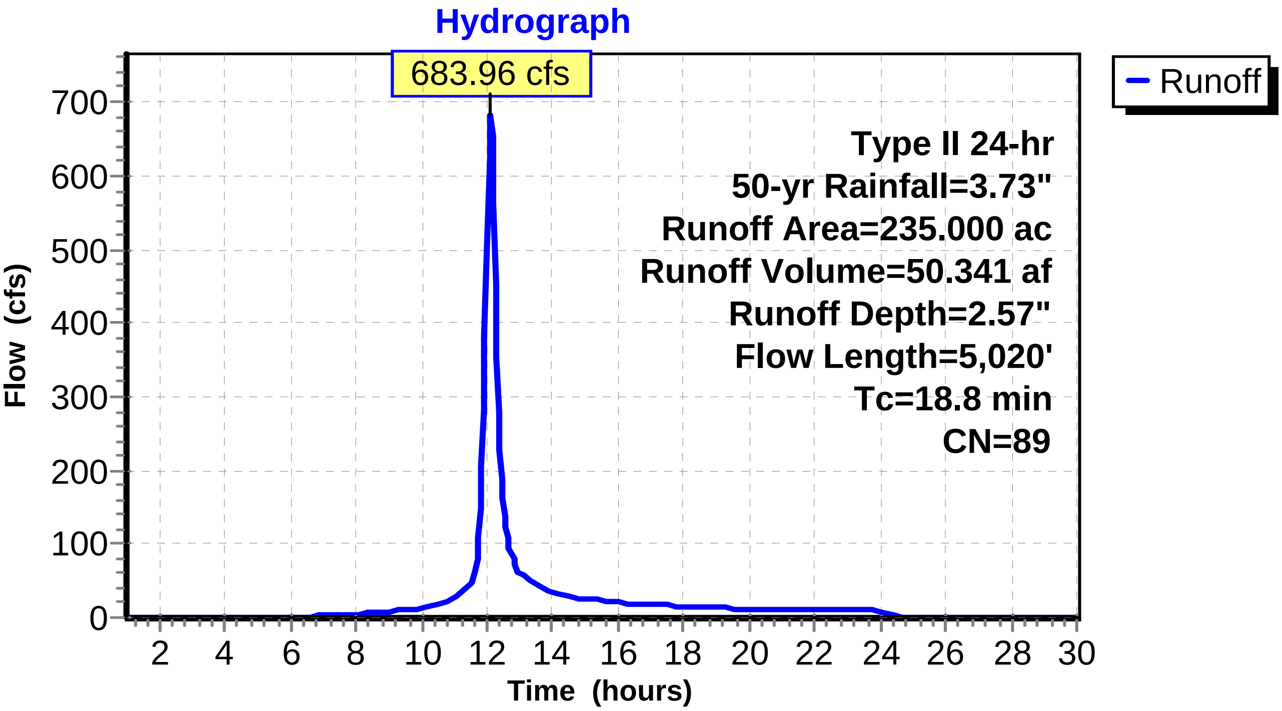
Runoff = 683.96 cfs @ 12.11 hrs, Volume= 50.341 af, Depth= 2.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 50-yr Rainfall=3.73"

| Area (ac) | CN | Description |
|---|---|---|
| 235.000 | 89 | Herbaceous range, Fair, HSG D |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 0.2 | 40 | 0.5300 | 3.09 | | **Sheet Flow, Sheet Flow**<br>Smooth surfaces n= 0.011 P2= 1.69" |
| 0.9 | 650 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated**<br>Unpaved Kv= 16.1 fps |
| 13.5 | 3,560 | 0.0183 | 4.40 | 6.60 | **Channel Flow, Reclaimed Channel West**<br>Area= 1.5 sf Perim= 4.2' r= 0.36'<br>n= 0.023 Earth, clean & winding |
| 4.2 | 770 | 0.0779 | 3.07 | 4.60 | **Channel Flow, Outside pit channel**<br>Area= 1.5 sf Perim= 4.3' r= 0.35' n= 0.067 |
| 18.8 | 5,020 | Total | | | |

### Subcatchment W: West



```
                    Time span=1.00-30.00 hrs, dt=0.05 hrs, 581 points
                   Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
            Reach routing by Stor-Ind+Trans method  -  Pond routing by Stor-Ind method

SubcatchmentC: Central                              Runoff Area=400.000 ac   Runoff Depth=3.15"
                           Flow Length=7,645'   Tc=70.0 min   CN=89   Runoff=599.81 cfs  105.099 af

SubcatchmentE: East                                 Runoff Area=405.000 ac   Runoff Depth=3.15"
                        Flow Length=6,058'   Tc=22.0 min   CN=89   Runoff=1,316.95 cfs  106.413 af

SubcatchmentW: West                                 Runoff Area=235.000 ac   Runoff Depth=3.15"
                             Flow Length=5,020'   Tc=18.8 min   CN=89   Runoff=832.67 cfs  61.746 af

    Total Runoff Area = 1,040.000 ac   Runoff Volume = 273.259 af   Average Runoff Depth = 3.15"
```

## Summary for Subcatchment C: Central

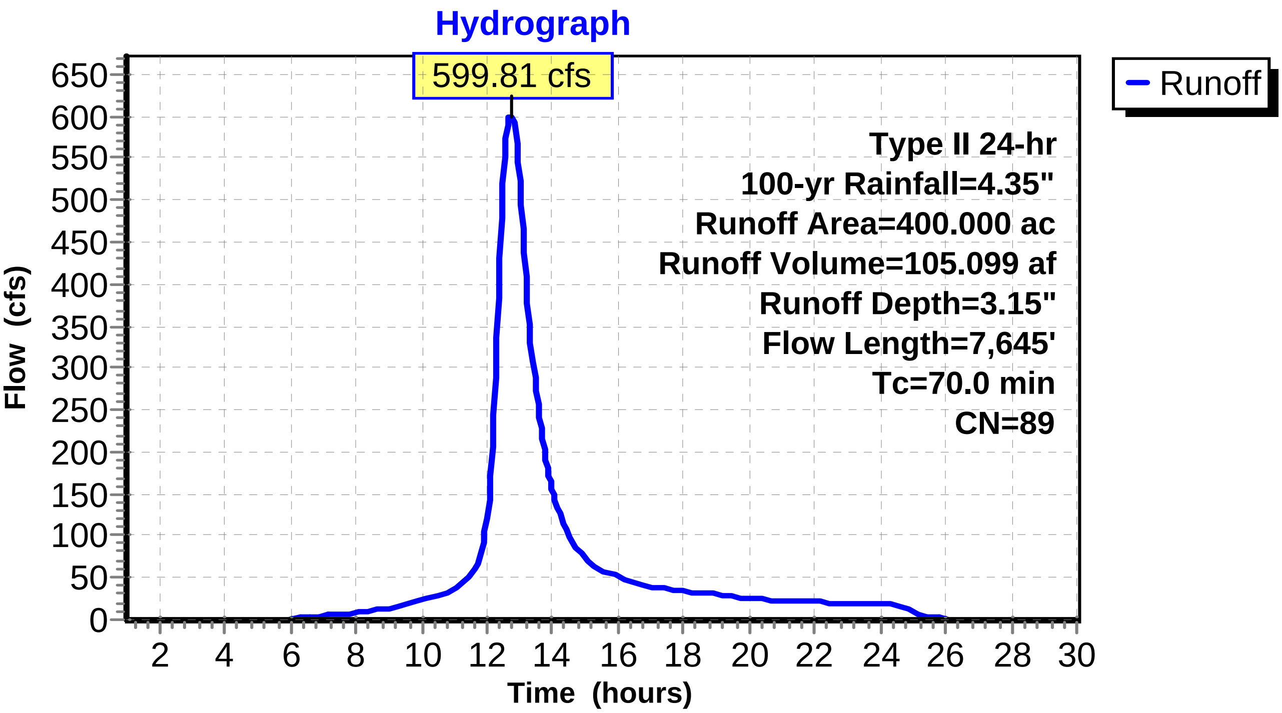
Runoff = 599.81 cfs @ 12.72 hrs, Volume= 105.099 af, Depth= 3.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=4.35"

| Area (ac) | CN | Description |
|---|---|---|
| 400.000 | 89 | Herbaceous range, Fair, HSG D |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 0.2 | 40 | 0.5300 | 3.09 | | **Sheet Flow, Sheet Flow**<br>Smooth surfaces n= 0.011 P2= 1.69" |
| 1.1 | 775 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated Flow**<br>Unpaved Kv= 16.1 fps |
| 61.0 | 5,310 | 0.0169 | 1.45 | 2.18 | **Channel Flow, Reclaimed channel Central**<br>Area= 1.5 sf Perim= 4.2' r= 0.36' n= 0.067 |
| 7.7 | 1,520 | 0.0888 | 3.28 | 4.91 | **Channel Flow, Channel outside pit Central**<br>Area= 1.5 sf Perim= 4.3' r= 0.35' n= 0.067 |
| 70.0 | 7,645 | Total | | | |

### Subcatchment C: Central



## Summary for Subcatchment E: East

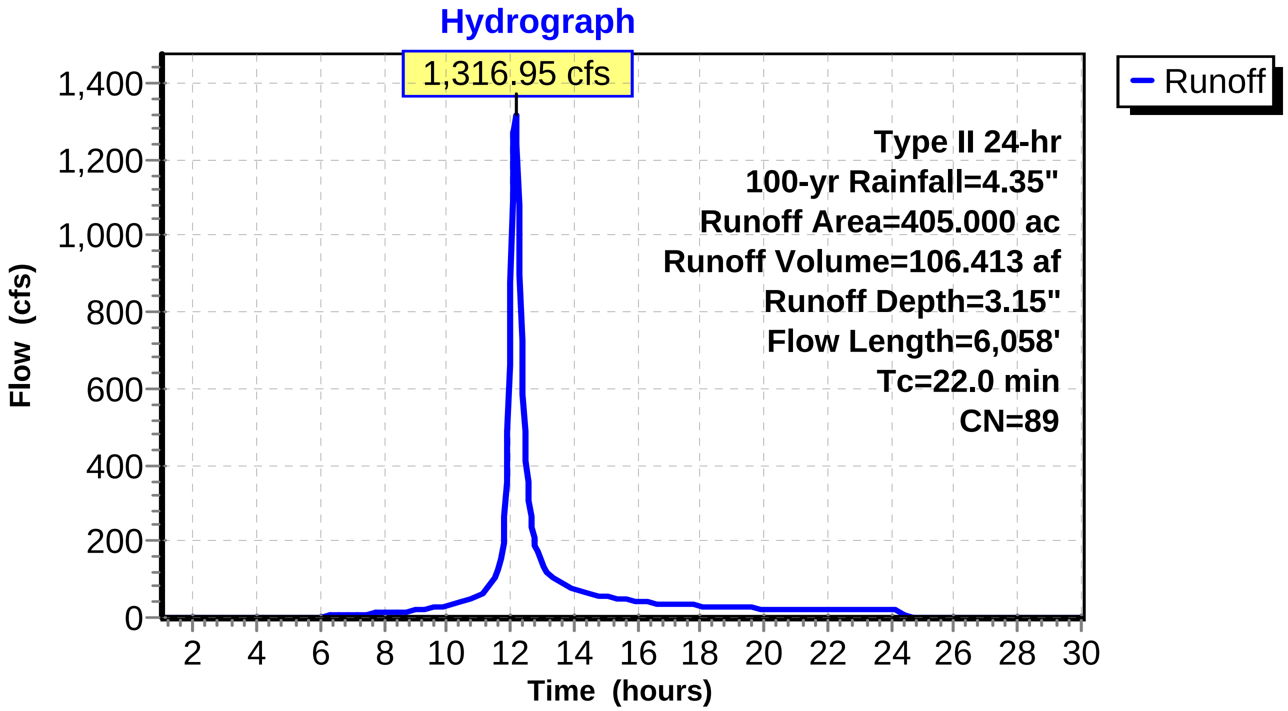
Runoff = 1,316.95 cfs @ 12.14 hrs, Volume= 106.413 af, Depth= 3.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=4.35"

| Area (ac) | CN | Description |
|---|---|---|
| 405.000 | 89 | Herbaceous range, Fair, HSG D |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 1.6 | 40 | 0.5300 | 0.43 | | **Sheet Flow, Sheet Flow**<br>Range n= 0.130 P2= 1.69" |
| 1.0 | 708 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated**<br>Unpaved Kv= 16.1 fps |
| 14.0 | 3,820 | 0.0196 | 4.55 | 6.83 | **Channel Flow, Reclaimed Channel within Pit East**<br>Area= 1.5 sf Perim= 4.2' r= 0.36'<br>n= 0.023 Earth, clean & winding |
| 5.4 | 1,490 | 0.1711 | 4.62 | 6.93 | **Channel Flow, Channel outside pit - East**<br>Area= 1.5 sf Perim= 4.2' r= 0.36' n= 0.067 |
| 22.0 | 6,058 | Total | | | |

### Subcatchment E: East



## Summary for Subcatchment W: West

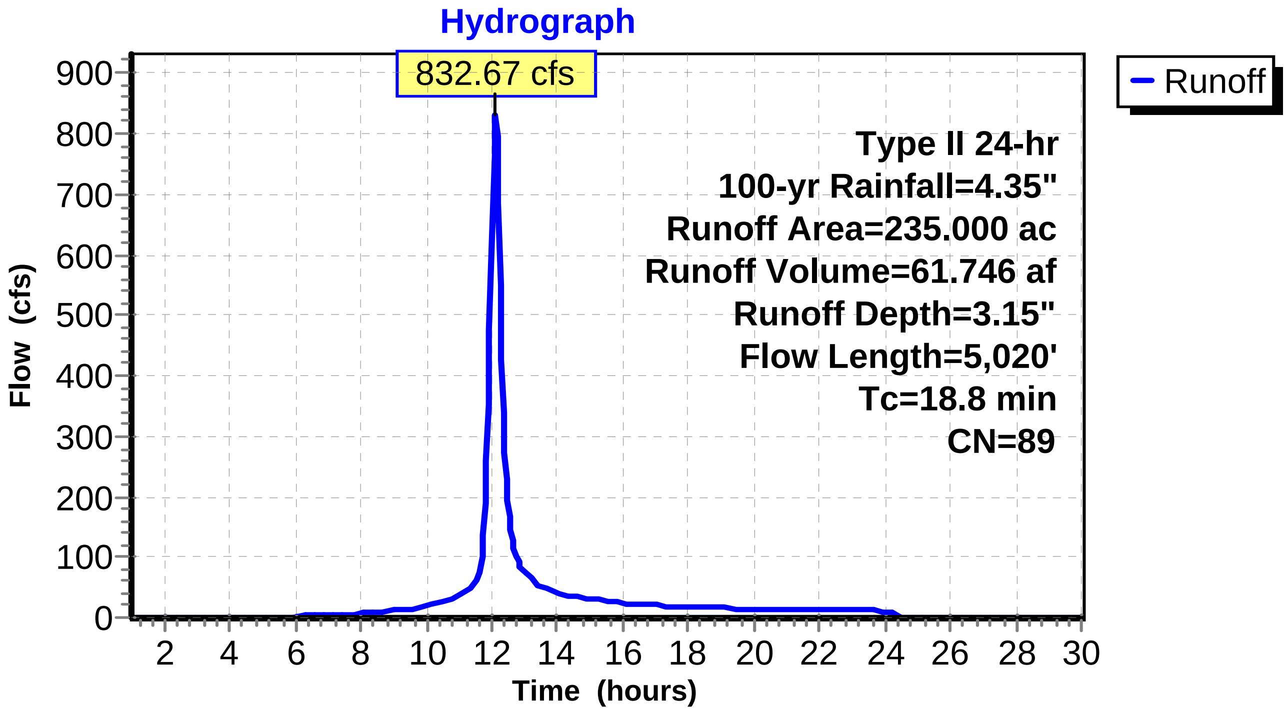
Runoff = 832.67 cfs @ 12.11 hrs, Volume= 61.746 af, Depth= 3.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-30.00 hrs, dt= 0.05 hrs
Type II 24-hr 100-yr Rainfall=4.35"

| Area (ac) | CN | Description |
|---|---|---|
| 235.000 | 89 | Herbaceous range, Fair, HSG D |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 0.2 | 40 | 0.5300 | 3.09 | | **Sheet Flow, Sheet Flow**<br>Smooth surfaces n= 0.011 P2= 1.69" |
| 0.9 | 650 | 0.5300 | 11.72 | | **Shallow Concentrated Flow, Concentrated**<br>Unpaved Kv= 16.1 fps |
| 13.5 | 3,560 | 0.0183 | 4.40 | 6.60 | **Channel Flow, Reclaimed Channel West**<br>Area= 1.5 sf Perim= 4.2' r= 0.36'<br>n= 0.023 Earth, clean & winding |
| 4.2 | 770 | 0.0779 | 3.07 | 4.60 | **Channel Flow, Outside pit channel**<br>Area= 1.5 sf Perim= 4.3' r= 0.35' n= 0.067 |
| 18.8 | 5,020 | Total | | | |

### Subcatchment W: West



Whetstone Associates

| | | |
|---|---|---|
| **To:** | Scott Duncan | **4189A** |
| **From:** | Scott Effner, P.G. | |
| **Date:** | December 15, 2019 | |
| **Subject:** | Drawdown Scoping Analysis - Parkdale Quarry EIS | |

## 1. INTRODUCTION

A MODFLOW-SURFACT simulation was prepared to provide a scoping-level analysis of the potential area that could be affected by groundwater drawdown related to passive dewatering of the proposed Parkdale Quarry Expansion. The purpose of the analysis was to define the area that should be included in the water resources analysis area for the Parkdale Quarry Environmental Impact Study (EIS). The model incorporates a number of simplifying but conservative assumptions that differ from the complex and relatively undocumented hydrogeologic conditions at the site. Model results are believed to significantly over estimate potential drawdowns in areas distal to the proposed quarry, and although it is an appropriate use of the model to conservatively determine the area that should be included in the water resources analysis, model results should not be interpreted to be predictions of the actual drawdowns that would occur from dewatering of the quarry.

## 2. MODEL CODE

The model was developed using MODFLOW-SURFACT 4.0 (HydroGeologic, 2011), a finite-difference code based on the USGS software package MODFLOW (McDonald and Harbaugh, 1988). MODFLOW-SURFACT is functionally identical to MODFLOW with several enhancements that improve its ability to solve numerical matrices. Model input and output files were processed using the graphical user interface software Groundwater Vistas version 6.96, build 49 (ESI, 2011).

## 3. MODEL DESCRIPTION AND INPUT PARAMETERS

The model considered an unconfined aquifer (layer type 1) simulated as a flat-lying single layer 520 feet thick. The model domain (Figure 1) is 106,000 x 106,000 feet wide (20.1 x 20.1 miles). It consists of 212 columns and 212 rows with a uniform cell spacing of 500 x 500 feet. The base reference elevation of the model was set at 5,780 feet. The top elevation of the model was set at 6,300 feet. A relatively flat, but east-flowing gradient of 0.00009 ft/ft was established across the model domain using constant head cells located on the east and west margins of the model grid (Figure 1). The assigned constant head elevations for the east and west margins were 6,275 and 6,285 feet respectively. No flow cells were assigned in the drainages for Currant Creek, Tallahassee Creek, and the Arkansas River where the surface elevations are below the level of the proposed pit floor (Figure 1). Given that the elevation of the pit floor (6,020 feet average, 5,940 minimum) is the lowest elevation to which groundwater levels could be drawn down, surface elevations below this level are areas into which the cone of depression cannot expand.

The following parameters were assigned to each cell in the model:

- Hydraulic conductivity = 0.0039 ft/d. This value is the mean of three single-well pumping tests that were performed in granitic rocks within the Sale Area (ERM 2019).

- Specific yield = 0.01. This is an estimated value from ERC 2019 that is considered to be reasonable for fractured granite.
- Recharge is not simulated in the model

## 4. MODEL RUNS

The model was prepared in three parts including an initial steady-state simulation that was completed to develop the pre-mining flow field and starting heads for the transient simulations that evaluated EIS Alternatives A and C. The transient runs simulated passive dewatering of the proposed quarry using drain cells within the respective footprints of the proposed mining areas. The stage elevations of the drains were set at 6,020 feet which is the average elevation of the proposed pit floors, and the drains in individual cells were specified to have areas of 500 x 500 feet, thicknesses of 10 feet, and hydraulic conductivities of 10 ft/d. Drains cells became active over the entire footprints of the proposed mining areas at the start of the simulations. The duration of the transient simulations was 100 years.

## 5. MODEL RESULTS

### 5.1 Steady State Run

The flow field for the steady-state simulation is shown in Figure 2. The simulation establishes a generally flat gradient with simulated heads of about 6,260 feet elevation within the sale area. Observed heads in the Sale Area range from about 6,027 to 6,260 feet elevation and the steady-state simulation provides a conservative starting point to evaluate the maximum drawdown that could occur from mining. The water balance mass error for the steady-state simulation was 0.12%.

### 5.2 Transient Simulations for Alternatives A and C

Drawdown contours for transient runs that evaluated Alternative A and Alternative C are presented in Figures 3 and 4, respectively. Given the conservative and simplistic nature of these scoping-level analyses, the 5-foot drawdown contours are considered to be the maximum extents of the areas in which drawdown-related impacts could occur from the Parkdale Quarry expansion under Alternatives A and C. The water balance mass errors for the Alternative A and Alternative C simulations were 0.00% and 0.03%, respectively.

## 6. DISCUSSION

The transient runs for Alternatives A and C were developed to define the areas in which groundwater levels could be theoretically reduced by 5 feet or more after 100 years of mining. The simulations incorporate numerous simplifying assumptions, the most important of which are: 1) groundwater near the proposed quarry expansion is well-connected over the modeled area in a flat-lying aquifer with a relatively flat water table, 2) the modeled area has consistent hydrogeologic characteristics, and 3) groundwater levels are drawn-down to the level of the final pit floor at the start of mining.

In reality, available water level data from DWR well records indicate that groundwater elevations in the modeled area vary widely, ranging from 5,657 to 7,041 feet elevation. The variation occurs over relatively short distances and often exceeds 100 to 200 feet between wells that are located within 1,000 to 2,000 feet of each other. The accuracy of the DWR water level data is affected by a number of factors including the accuracy of the reported well locations, completion details for individual wells, and the range of time over which the groundwater levels were measured. However, it is noted that the reported variability is consistent with groundwater systems in low-permeable rocks that are poorly interconnected over short distances.

A number of major faults occur near the Sale Area are not simulated. These faults include the Parkdale Fault, unnamed faults 1 and 2, and the Mikesell Gulch Fault (Figure 5). The Parkdale Fault is located north of the Sale Area and places granitic rocks in contact with younger sedimentary rocks. The majority of groundwater users within the defined area of potential impact are located on the north side of the Parkdale Fault and have wells in sedimentary rocks that are expected to have different hydraulic characteristics than the granite that would be mined. Water from perennial sections of Currant and Cottonwood creeks are sources of recharge to the sedimentary rocks. The stream become intermittent where they cross the sedimentary rocks near State Highway 9. A number of smaller intermittent drainages located northeast of the highway also contribute runoff that infiltrates into the sedimentary rocks. The different hydraulic characteristics of the sedimentary rocks and additional recharge they receive from surface water are not considered in the model which tends to increase the conservatism of the predicted drawdowns in areas north of the proposed quarry expansion.

Finally, the simulation of water levels being drawn down to the level of the ultimate pit floor at the start of mining is inherently conservative. Groundwater drawdown would occur gradually as the mine is developed over its expected 100-year life.

For the reasons stated above, the results of the transient simulations are believed to significantly over estimate potential drawdowns in areas distal to the proposed quarry. Therefore, the modeled drawdown contours presented in Figures 3 and 4 should not be interpreted to be predictions of the actual drawdown that would occur at any given location from the proposed quarry expansion.

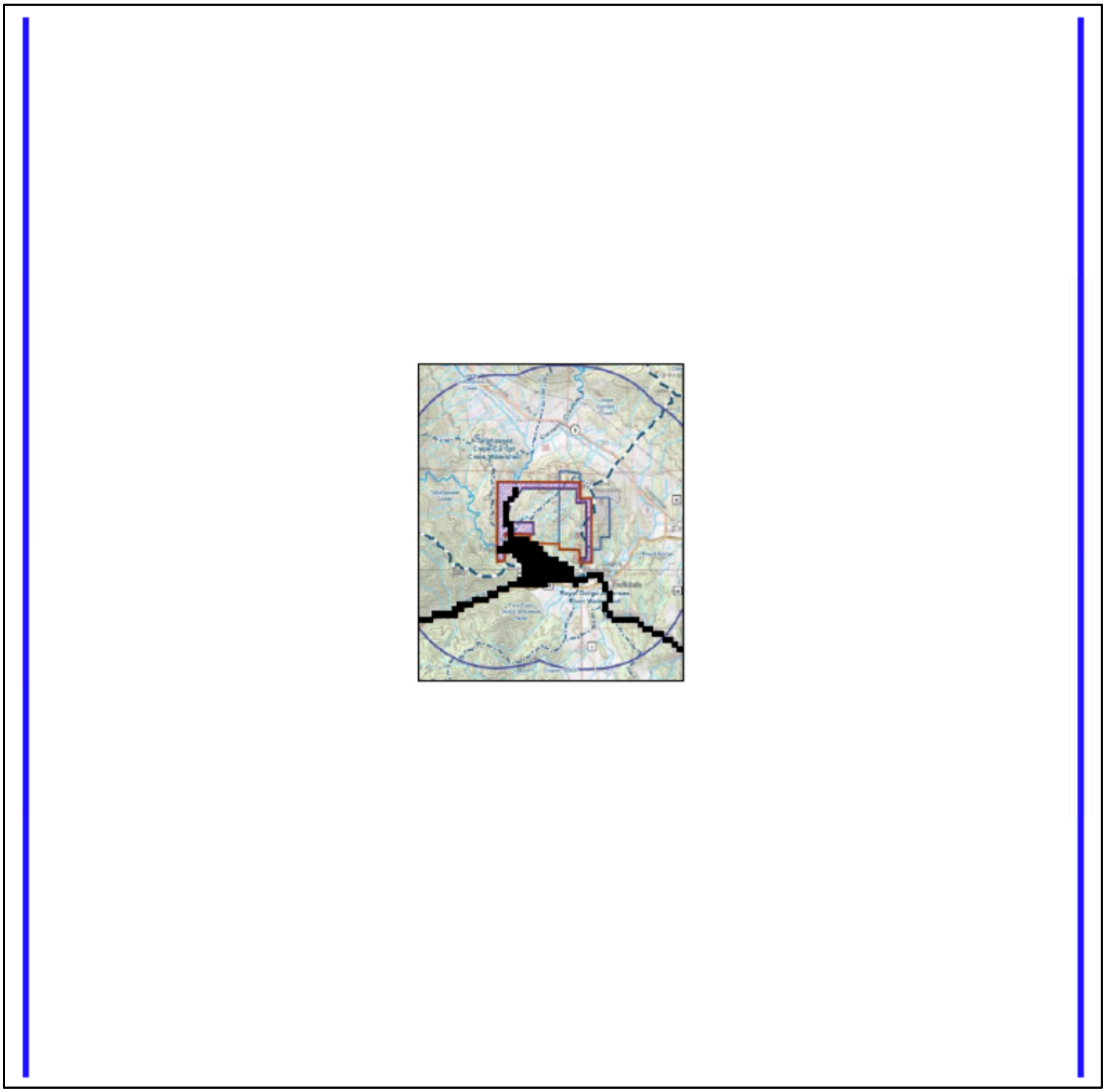


***Figure 1.  Model Domain and Boundary Conditions***

The blue lines at the east and west borders are the locations of the constant head cells.  The black lines and black field within the map image are the locations of no flow cells where the surface topography is below the elevation of the planned pit floor.

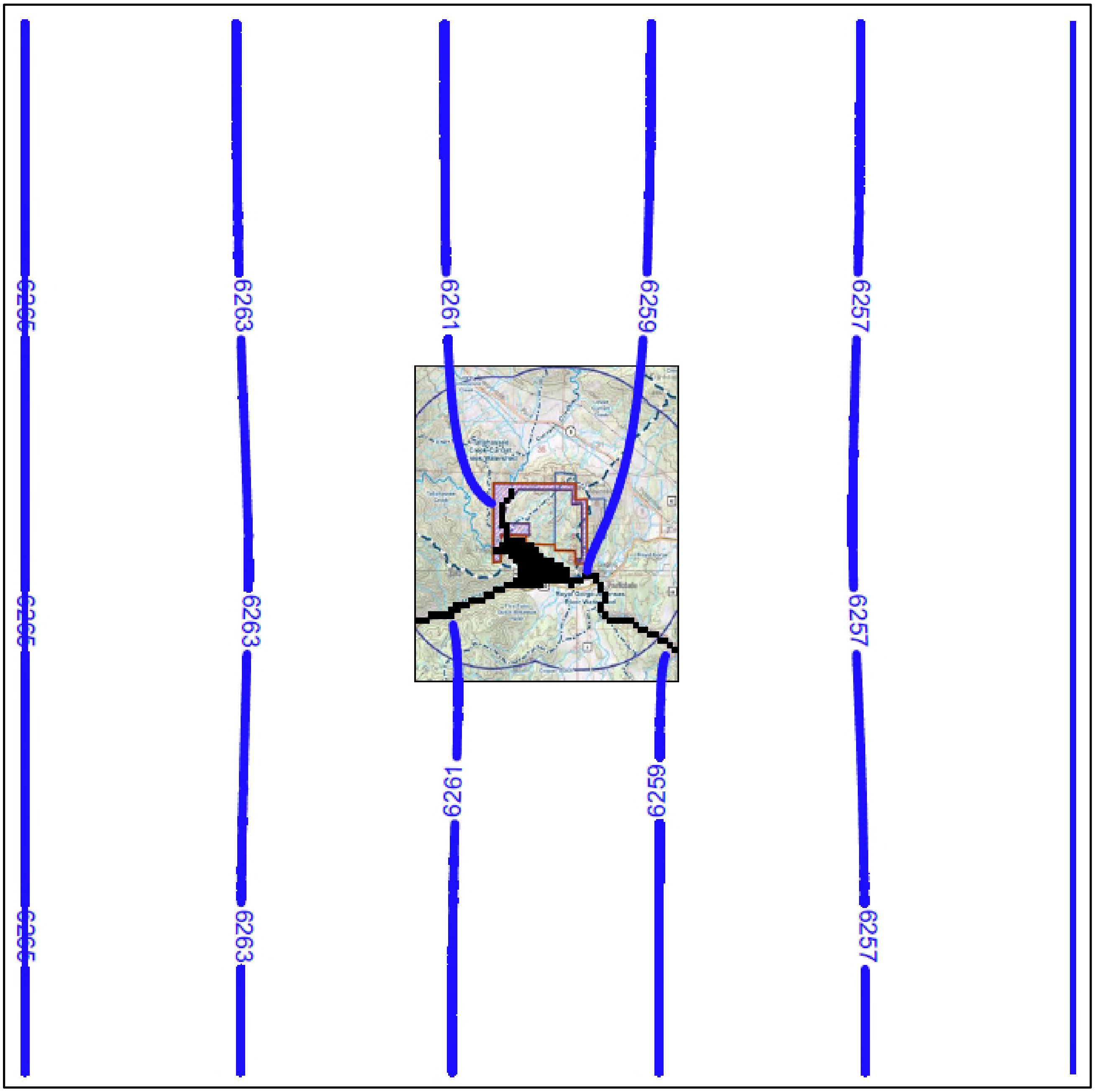


*Figure 2. Steady State Flow Field*

The blue contours indicated the modeled steady-state water levels. The black lines and black field within the map image are the locations of no flow cells where the surface topography is below the elevation of the planned pit floor.

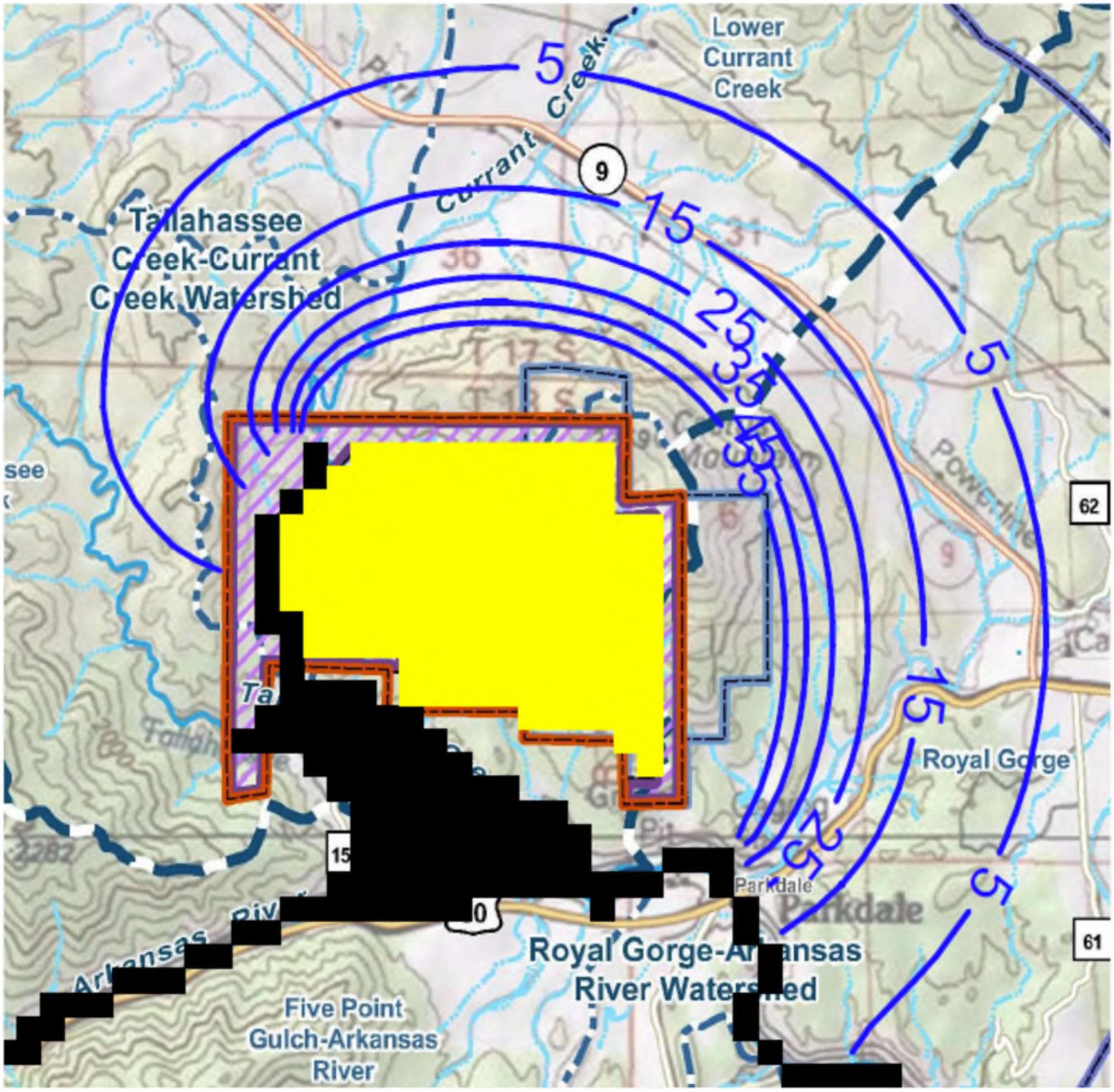


*Figure 3. Modeled Drawdown for Alternative A*

The yellow field within the mining area for Alternative A indicates the locations of drain cells. The black lines and black field south and east of the Sale Area are the locations of no flow cells where the surface topography is below the elevation of the planned pit floor.

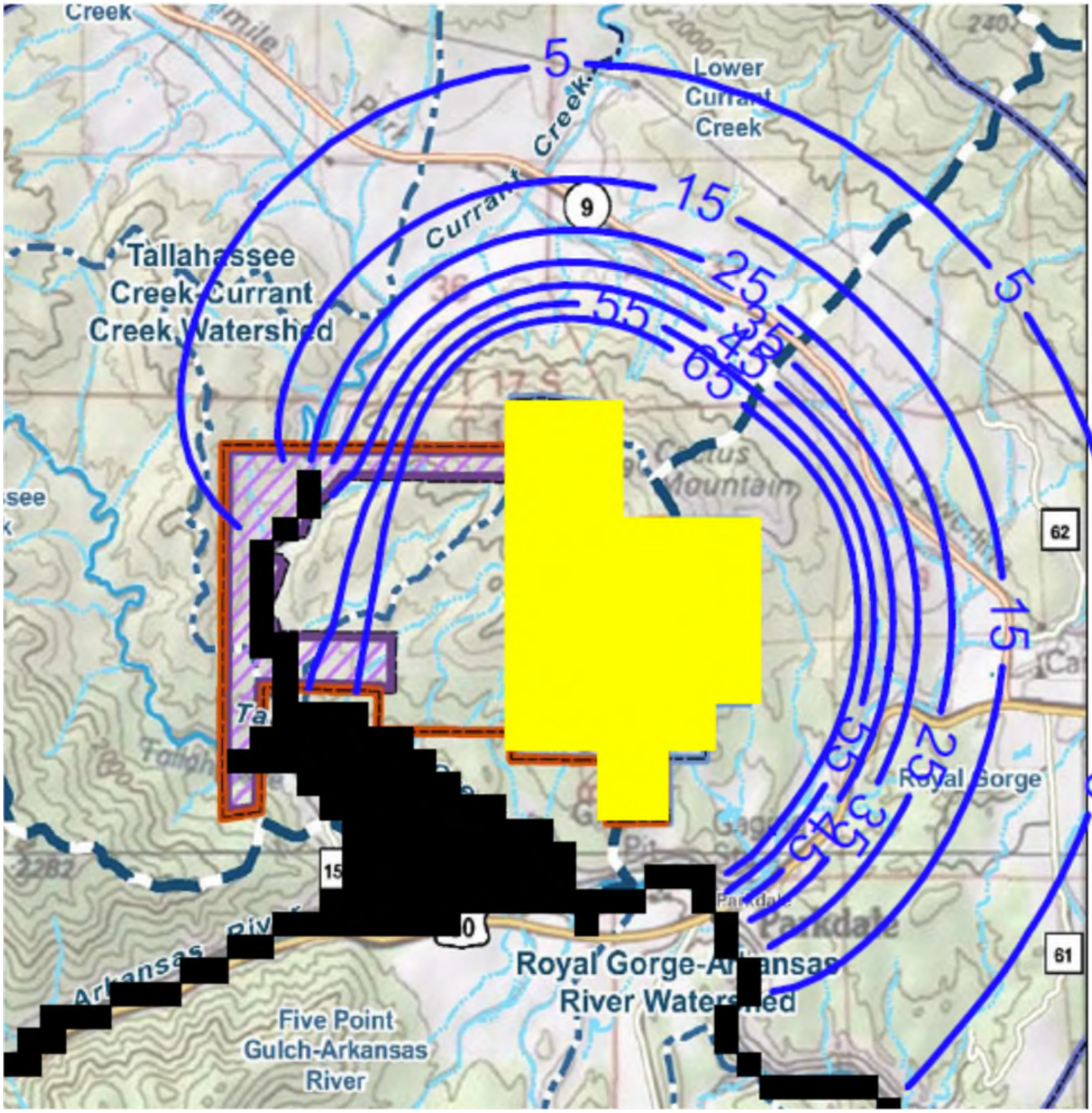

Creek
Lower Currant Creek
Currant
Creek
Tallahassee Creek-Currant Creek Watershed
Cactus Mountain
Royal Gorge
Royal Gorge-Arkansas River Watershed
Five Point Gulch-Arkansas River
Arkansas River
Parkdale
9
62
61
5
15
25
35
45
55
65

*Figure 4. Modeled Drawdown for Alternative C*

The yellow field within the mining area for Alternative C indicates the locations of drain cells. The black lines and black field south and east of the Sale Area are the locations of no flow cells where the surface topography is below the elevation of the planned pit floor.

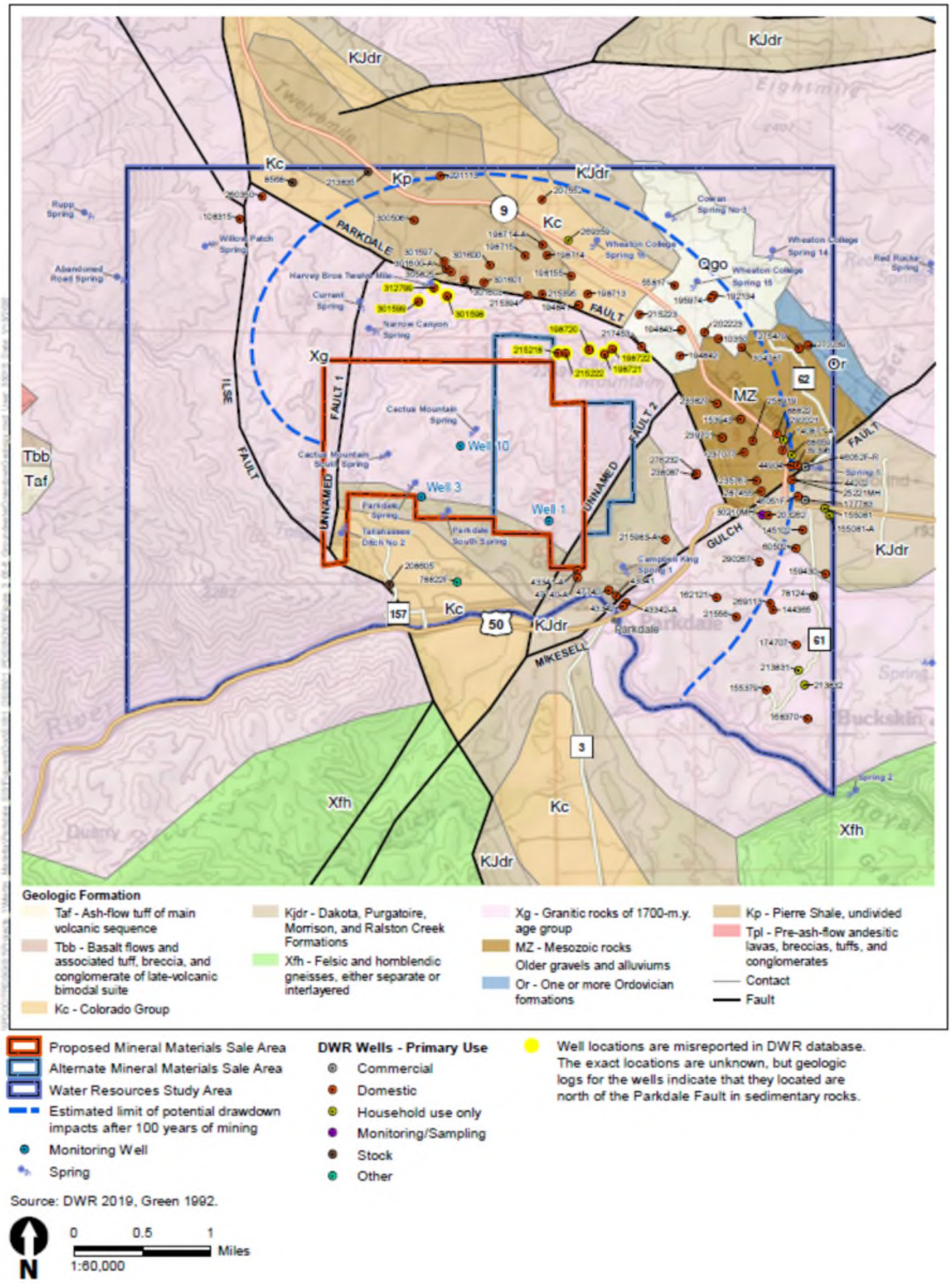

KJdr
Kc
Kp
Xg
Xfh
MZ
Qgo
Or
Tbb
Taf
PARKDALE FAULT
FAULT 1
UNNAMED FAULT
ILSE FAULT
UNNAMED FAULT 2
GULCH FAULT
Well 10
Well 3
Well 1
Cactus Mountain Spring
Cactus Mountain South Spring
Parkdale Spring
Tallahassee Ditch No 2
Parkdale South Spring
Campbell King Spring 1
Narrow Canyon Spring
Currant Spring
Harvey Bros Twelve Mile
Rupp Spring
Willow Patch Spring
Abandoned Road Spring
Cowan Spring No 1
Wheaton College Spring
Wheaton College Spring 14
Wheaton College Spring 15
Red Rocks Spring
Spring 2
Spring 5
Parkdale
MIKESELL
9
157
50
3
61
62
Geologic Formation
Taf - Ash-flow tuff of main volcanic sequence
Tbb - Basalt flows and associated tuff, breccia, and conglomerate of late-volcanic bimodal suite
Kc - Colorado Group
Kjdr - Dakota, Purgatoire, Morrison, and Ralston Creek Formations
Xfh - Felsic and hornblendic gneisses, either separate or interlayered
Xg - Granitic rocks of 1700-m.y. age group
MZ - Mesozoic rocks
Older gravels and alluviums
Or - One or more Ordovician formations
Kp - Pierre Shale, undivided
Tpl - Pre-ash-flow andesitic lavas, breccias, tuffs, and conglomerates
Contact
Fault
Proposed Mineral Materials Sale Area
Alternate Mineral Materials Sale Area
Water Resources Study Area
Estimated limit of potential drawdown impacts after 100 years of mining
Monitoring Well
Spring
DWR Wells - Primary Use
Commercial
Domestic
Household use only
Monitoring/Sampling
Stock
Other
Well locations are misreported in DWR database. The exact locations are unknown, but geologic logs for the wells indicate that they located are north of the Parkdale Fault in sedimentary rocks.
Source: DWR 2019, Green 1992.
N
0
0.5
1
Miles
1:60,000

*Figure 5. Geology within the Modeled Area*

## 7. REFERENCES

BLM 2017. Environmental Assessment, Parkdale Area Mineral Materials Sampling, U.S. Bureau of Land Management Royal Gorge Field Office, DOI-BLM-CO-F020-2016-0083 EA, December, 2017

ERM 2019. Interim Hydrogeologic Assessment, Parkdale Quarry Expansion Area, prepared by Environmental Resources Management (ERM) for Martin Marietta Materials, Project No. 0488586, August 20, 2019.

ESI (Environmental Simulations Inc.), 2004. Groundwater Vistas vol.4. A graphical User Interface for the preparation of numerical groundwater models.

HydroGeologic. 2011. MODFLOW-SURFACT MODHMS Version 4.0, Enhanced Version of the U.S. Geological Survey Modular Groundwater Flow Model with Hydrologic Modeling Simulation Capability.

MacDonald, M.G. and A.W. Harbaugh. 1988. A modular three-dimensional finite-difference groundwater flow model: U.S. Geological Survey Techniques of Water Resources Investigations Book 6, chapter A1.

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***Preliminary Draft Environmental Impact Statement***
***Parkdale Quarry Expansion Project***

# *Appendix G*

Well Data and Surface Water Rights

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Surface Water Rights in the Water Resources Study Area

| OBJECTID * | Shape * | WDID | Structure Name | Structure Type |
|---|---|---|---|---|
| 3 | Point | 1200854 | TALLAHASSEE DITCH NO 1 | Ditch |
| 4 | Point | 1200570 | PIONEER DITCH CURRENT CK | Ditch |
| 5 | Point | 1200573 | THIRD DITCH | Ditch |
| 7 | Point | 1200928 | CC ROYAL GORGE INTAKE | Ditch |
| 8 | Point | 1200928 | CC ROYAL GORGE INTAKE | Ditch |
| 9 | Point | 1203021 | CURRANT CREEK MIN FLOW | Minimum Flow |
| 10 | Point | 1203020 | CURRANT CREEK MIN FLOW | Minimum Flow |
| 11 | Point | 1203011 | TALLAHASSEE CR MIN FLOW | Minimum Flow |
| 13 | Point | 1202834 | HASP CURRANT CREEK EXCHANGE | Reach |
| 14 | Point | 1202835 | HASP TALLAHASSEE CRK EXCHANGE | Reach |
| 18 | Point | 1200857 | TALLAHASSEE DITCH NO 2 | Spring |
| 19 | Point | 1202149 | PARKDALE SPRING | Spring |
| 20 | Point | 1202400 | HARVEY BROS TWELVE MILE | Spring |
| 22 | Point | 1202067 | CACTUS MOUNTAIN SPRING | Spring |
| 24 | Point | 1202549 | WHEATON COLLEGE SPG 16 | Spring |
| 25 | Point | 1202247 | CAMPBELL KING SPRING 1 | Spring |
| 26 | Point | 1202281 | COWAN SPRING NO 3 | Spring |
| 27 | Point | 1202548 | WHEATON COLLEGE SPG 15 | Spring |
| 29 | Point | 1202547 | WHEATON COLLEGE SPG 14 | Spring |

Surface Water Rights in the Water Resources Study Area

| Water Source | GNIS ID | Stream Mile | Q10 | Q40 | Q160 | Section | Township | Range | PM | UTM x |
|---|---|---|---|---|---|---|---|---|---|---|
| TALLAHASSEE CREEK | 191571 | 2.27 | N/A | SE | NW | 11 | 18.0 S | 72.0 W | S | 463886 |
| CURRANT CREEK | 191396 | 0.31 | N/A | SW | NE | 11 | 18.0 S | 72.0 W | S | 464442 |
| CURRANT CREEK | 191396 | 0 | N/A | SW | SE | 12 | 18.0 S | 72.0 W | S | 466062.9 |
| ARKANSAS RIVER | 78956 | 247.75 | N/A | NE | NW | 20 | 18.0 S | 71.0 W | S | 469086 |
| ARKANSAS RIVER | 78956 | 247.75 | N/A | NE | NW | 20 | 18.0 S | 71.0 W | S | 469086 |
| CURRANT CREEK | 191396 | 0 | N/A | SE | NE | 11 | 18.0 S | 72.0 W | S | 464691.4 |
| CURRANT CREEK | 191396 | 2.86 | N/A | NE | SW | 36 | 17.0 S | 72.0 W | S | 465156 |
| TALLAHASSEE CREEK | 191571 | 0.02 | N/A | SW | SW | 7 | 18.0 S | 71.0 W | S | 466824.2 |
| CURRANT CREEK | 191396 | 0.01 | N/A | SE | NE | 11 | 18.0 S | 72.0 W | S | 464675.1 |
| TALLAHASSEE CREEK | 191571 | 0.03 | N/A | SW | SW | 7 | 18.0 S | 71.0 W | S | 466802.6 |
| TALLAHASSEE CREEK | 191571 | <Null> | N/A | NE | SW | 11 | 18.0 S | 72.0 W | S | 464199 |
| ARKANSAS RIVER | 78956 | <Null> | N/A | NE | NE | 11 | 18.0 S | 72.0 W | S | 464836.3 |
| ARKANSAS RIVER | 78956 | <Null> | N/A | NE | SW | 36 | 17.0 S | 72.0 W | S | 465207 |
| ARKANSAS RIVER | 78956 | <Null> | N/A | SE | NW | 1 | 18.0 S | 72.0 W | S | 465656.6 |
| ARKANSAS RIVER | 78956 | <Null> | NW | SE | NW | 31 | 17.0 S | 71.0 W | S | 467177.9 |
| ARKANSAS RIVER | 78956 | <Null> | N/A | SW | SE | 7 | 18.0 S | 71.0 W | S | 467676.3 |
| ARKANSAS RIVER | 78956 | <Null> | N/A | NE | NE | 31 | 17.0 S | 71.0 W | S | 468072 |
| ARKANSAS RIVER | 78956 | <Null> | NW | NW | SW | 32 | 17.0 S | 71.0 W | S | 468356.3 |
| ARKANSAS RIVER | 78956 | <Null> | SW | SE | NE | 32 | 17.0 S | 71.0 W | S | 469260.1 |

Surface Water Rights in the Water Resources Study Area

| UTM y | Latitude | Longitude | Location Accuracy | Adjudication Date | Previous Adj Date |
|---|---|---|---|---|---|
| 4260943 | 38.496116 | -105.414148 | GPS | 24884 | 3/13/1954 |
| 4261224 | 38.498671 | -105.407787 | GPS | 24884 | 3/13/1954 |
| 4260225.6 | 38.48973 | -105.38914 | Spotted from quarters | 24884 | 3/13/1954 |
| 4258268 | 38.472205 | -105.3544 | Digitized | 02/03/1894 | <Null> |
| 4258268 | 38.472205 | -105.3544 | Digitized | 5889 | <Null> |
| 4260867.8 | 38.495464 | -105.404899 | Digitized | 38352 | 12/31/2003 |
| 4263742 | 38.521385 | -105.399714 | User supplied | 38352 | 12/31/2003 |
| 4260005.6 | 38.487776 | -105.380401 | Digitized | 35064 | 12/31/1994 |
| 4260865.6 | 38.495454 | -105.405097 | GPS | 37680 | 12/31/2002 |
| 4259991.1 | 38.48765 | -105.380653 | GPS | 37680 | 12/31/2002 |
| 4260867 | 38.495444 | -105.410555 | GPS | 24884 | 3/13/1954 |
| 4261491.6 | 38.501092 | -105.403269 | Spotted from quarters | 29951 | <Null> |
| 4263761.6 | 38.521563 | -105.39913 | Spotted from quarters | 26664 | 12/31/1971 |
| 4262591.6 | 38.511037 | -105.393915 | Spotted from quarters | 29951 | <Null> |
| 4264252.1 | 38.526058 | -105.376544 | Spotted from quarters | 27029 | 12/31/1972 |
| 4260222.6 | 38.489763 | -105.370641 | Spotted from quarters | 31777 | 12/31/1985 |
| 4264565.6 | 38.528916 | -105.366302 | Spotted from quarters | 27029 | 12/31/1972 |
| 4263767.2 | 38.521738 | -105.363014 | Spotted from quarters | 27029 | 12/31/1972 |
| 4264130.6 | 38.525038 | -105.352652 | Spotted from quarters | 27029 | 12/31/1972 |

Surface Water Rights in the Water Resources Study Area

| Appropriation Date | Admin No | Order No | Priority No | Associated Case Numbers | Decreed Uses |
|---|---|---|---|---|---|
| 12/31/1871 | 38057.08035 | 9 | B-2 | CA8757 | 1 |
| 12/31/1861 | 38057.04383 | 9 | B-1 | CA8757 | 1 |
| 04/01/1875 | 38057.09222 | 9 | B-3 | CA8757 | 1 |
| 12/30/1863 | 5112 | 9 | 17 | CA3203 | 2 |
| 08/13/1864 | 5339 | 9 | NI5 | CA3203 | 2 |
| 38014 | 56275 | 0 | N/A | 04CW0081 | M |
| 38014 | 56275 | 0 | N/A | 04CW0080 | M |
| 35009 | 53270 | 0 | N/A | 95CW0232 | M |
| 37594 | 55882.55855 | 0 | N/A | 03CW0019 | Q |
| 37594 | 55882.55855 | 0 | N/A | 03CW0019 | Q |
| 3954 | 38057.22215 | 9 | B-10 | CA8757 | 18 |
| 9604 | 27865 | 0 | N/A | 81CW0145 | 8FW |
| 15706 | 44559.33967 | 0 | N/A | W2160 | 1 |
| 9604 | 27865 | 0 | N/A | 81CW0145 | 8FW |
| 6649 | 44925.2491 | 0 | N/A | W3923 | 29 |
| 31581 | 49842 | 0 | N/A | 86CW0050 | 89 |
| 11504 | 44925.29765 | 0 | N/A | W4059 | 8 |
| 6548 | 44925.24809 | 0 | N/A | W3923 | 29 |
| 9155 | 44925.27416 | 0 | N/A | W3923 | 29 |

Surface Water Rights in the Water Resources Study Area

| Net Absolute | Net Conditional | Net APEX Absolute | Net APEX Conditional | Decreed Units |
|---|---|---|---|---|
| 3.5 | 0 | 0 | 0 | C |
| 3.75 | 0 | 0 | 0 | C |
| 4 | 0 | 0 | 0 | C |
| 19 | 0 | 0 | 0 | C |
| 3.5 | 0 | 0 | 0 | C |
| 1.9 | 0 | 0 | 0 | C |
| 2 | 0 | 0 | 0 | C |
| 1 | 0 | 0 | 0 | C |
| 0 | 0 | 0 | 2 | C |
| 0 | 0 | 0 | 2 | C |
| 14 | 0 | 0 | 0 | C |
| 0.0022 | 0 | 0 | 0 | C |
| 3.2 | 0 | 0 | 0 | C |
| 0.0022 | 0 | 0 | 0 | C |
| 0.022 | 0 | 0 | 0 | C |
| 0.01 | 0 | 0 | 0 | C |
| 0.013 | 0 | 0 | 0 | C |
| 0.0044 | 0 | 0 | 0 | C |
| 0.0088 | 0 | 0 | 0 | C |

| Seasonal Limits |
|---|
| No |
| No |
| No |
| No |
| No |
| Yes |
| Yes |
| Yes |
| No |
| No |
| No |
| No |
| No |
| No |
| No |
| No |
| No |
| No |
| No |

| Comments |
|---|
| NO ACREAGE AMT DECREED; ENFORCEABLE AS OF 3-13-1954 SEE CA 6806 |
| NO ACREAGE AMT DECREED ENFORCEABLE AS OF 3-13-1954 SEE CA6806 |
| NO ACREAGE AMT DECREED SEE ALSO CA6806 ENFORCEABLE AS OF3-13-1954 |
| TF CANON CITY HYDRAULIC ID 505 |
| TF OLD CANON CITY WW INTAKE ID 930 |
| CWCB MIN FLOW RIGHT THIRTYONE MILE CREEK CONFLUENCE DOWN TO MILL GULCH CONFLUENCE |
| CWCB MIN FLOW RIGHT MILL GULCH CONFLUENCE TO COTTONWOOD CRK CONFLUENCE |
| CWCB MINIMUM FLOW |
| FOR SUBSTITUTION AND EXCHANGE OF TL SHARES AND/OR DIV 1 CHANGED SOURCES FOR HASP AUG PLAN |
| FOR SUBSTITUTION AND EXCHANGE OF TL SHARES AND/OR DIV 1 CHANGED SOURCES FOR HASP AUG PLAN |
| NO ACREAGE AMT DECREED ENFORCEABLE AS OF 3-13-1954 |
| BLM - RESERVED RIGHTS |
| N/A |
| BLM - RESERVED RIGHTS |
| CONDITIONAL RIGHT FOR MUNICIPAL USE, SEE 85CW066 (CORRECTED LOCATION) NON TRIB, CONDITIONAL RIGH |
| DOMESTIC IN-HOUSE FOR ONE CABIN AND LIVESTOCK |
| N/A |
| CONDITIONAL RIGHT FOR MUNICIPAL USE, SEE 85CW066 (CORRECTED LOCATION) NON TRIB, CONDITIONAL RIGH |
| CONDITIONAL RIGHT FOR MUNICIPAL USE, SEE 85CW066 (CORRECTED LOCATION) NON TRIB, CONDITIONAL RIGH |

| Modified | More Information |
|---|---|
| 4/2/2019 13:29 | https://dwr.state.co.us/Tools/WaterRights/NetAmounts/926705 |
| 5/2/2013 11:34 | https://dwr.state.co.us/Tools/WaterRights/NetAmounts/431774 |
| 5/2/2013 11:35 | https://dwr.state.co.us/Tools/WaterRights/NetAmounts/431777 |
| 5/1/2013 15:27 | https://dwr.state.co.us/Tools/WaterRights/NetAmounts/432385 |
| 5/1/2013 15:27 | https://dwr.state.co.us/Tools/WaterRights/NetAmounts/432386 |
| 3/8/2012 10:33 | https://dwr.state.co.us/Tools/WaterRights/NetAmounts/433551 |
| 3/8/2012 9:55 | https://dwr.state.co.us/Tools/WaterRights/NetAmounts/433550 |
| 12/11/2012 15:50 | https://dwr.state.co.us/Tools/WaterRights/NetAmounts/433541 |
| 7/26/2018 14:45 | https://dwr.state.co.us/Tools/WaterRights/NetAmounts/856707 |
| 7/26/2018 14:46 | https://dwr.state.co.us/Tools/WaterRights/NetAmounts/856709 |
| 5/2/2013 11:37 | https://dwr.state.co.us/Tools/WaterRights/NetAmounts/432250 |
| 4/20/2017 15:46 | https://dwr.state.co.us/Tools/WaterRights/NetAmounts/631603 |
| 12/15/1997 | https://dwr.state.co.us/Tools/WaterRights/NetAmounts/433074 |
| 4/20/2017 13:58 | https://dwr.state.co.us/Tools/WaterRights/NetAmounts/631521 |
| 2/18/2000 | https://dwr.state.co.us/Tools/WaterRights/NetAmounts/433226 |
| 12/1/1999 | https://dwr.state.co.us/Tools/WaterRights/NetAmounts/432921 |
| 12/24/1997 | https://dwr.state.co.us/Tools/WaterRights/NetAmounts/432954 |
| 4/3/2000 | https://dwr.state.co.us/Tools/WaterRights/NetAmounts/433225 |
| 1/12/2001 | https://dwr.state.co.us/Tools/WaterRights/NetAmounts/433224 |

Surface Water Rights in the Water Resources Study Area

| Location | Proximity |
|---|---|
| (38.496116, -105.414148) | Water Resources Study Area |
| (38.498671, -105.407787) | Water Resources Study Area |
| (38.48973, -105.38914) | Water Resources Study Area |
| (38.472205, -105.3544) | Water Resources Study Area |
| (38.472205, -105.3544) | Water Resources Study Area |
| (38.495464, -105.404899) | Water Resources Study Area |
| (38.521385, -105.399714) | Water Resources Study Area |
| (38.487776, -105.380401) | Water Resources Study Area |
| (38.495454, -105.405097) | Water Resources Study Area |
| (38.48765, -105.380653) | Water Resources Study Area |
| (38.495444, -105.410555) | Water Resources Study Area |
| (38.501092, -105.403269) | Water Resources Study Area |
| (38.521563, -105.39913) | Water Resources Study Area |
| (38.511037, -105.393915) | Water Resources Study Area |
| (38.526058, -105.376544) | Water Resources Study Area |
| (38.489763, -105.370641) | Water Resources Study Area |
| (38.528916, -105.366302) | Water Resources Study Area |
| (38.521738, -105.363014) | Water Resources Study Area |
| (38.525038, -105.352652) | Water Resources Study Area |

| Permit | Current Status | Contact Name | DIV | WD | County |
|---|---|---|---|---|---|
| 25221MH | Well Constructed | MASSEY, LEE | 2 | 12 | FREMONT |
| 30210MH | Well Constructed | SHIPPEY, RONALD | 2 | 12 | FREMONT |
| 78124 | Well Constructed | BARTLESON | 2 | 12 | FREMONT |
| 88822 | Well Constructed | LITTLEFIELD, GEORGE L | 2 | 12 | FREMONT |
| 140871-A | Well Constructed | CROWFOOT, FLOYD | 2 | 12 | FREMONT |
| 145102 | Well Constructed | PRUETT, FLOYD D | 2 | 12 | FREMONT |
| 153943 | Well Constructed | NUTLY, ALBERT J. | 2 | 12 | FREMONT |
| 43341-A | Well Constructed | AJET | 2 | 12 | FREMONT |
| 153943 | Well Constructed | NUTLY, MARY ANN | 2 | 12 | FREMONT |
| 155081 | Well Constructed | KRESKI, JOHN | 2 | 12 | FREMONT |
| 155081-A | Well Constructed | MORENO LEIDY SASTOQUE | 2 | 12 | FREMONT |
| 155379 | Well Constructed | BURKHOLDER NORMAN L & CONNIE J | 2 | 12 | FREMONT |
| 47740-A | Well Constructed | KING ALEXANDER CAMPBELL | 2 | 12 | FREMONT |
| 159430 | Well Constructed | TOLLIS, GENE P | 2 | 12 | FREMONT |
| 162121 | Well Constructed | BROWN, MARK N | 2 | 12 | FREMONT |
| 168370 | Well Constructed | JOHNSON CURTIS & BLACKE HELENE | 2 | 12 | FREMONT |
| 174707 | Well Constructed | TOLLIS, ERNIE P | 2 | 12 | FREMONT |
| 177783 | Well Constructed | KRIZMAN, ARTHUR | 2 | 12 | FREMONT |
| 192134 | Well Constructed | BOWERS SPENCER & LINDSEY | 2 | 12 | FREMONT |
| 46051F | Well Constructed | CAMP SCHIRADO LLC | 2 | 12 | FREMONT |
| 194842 | Well Constructed | DUNCAN, GEORGIA L | 2 | 12 | FREMONT |
| 194843 | Well Constructed | EMBRY, JACK | 2 | 12 | FREMONT |
| 194841 | Well Constructed | SKEPI, ESAT | 2 | 12 | FREMONT |
| 194841 | Well Constructed | ROFOFSKY, DAVID W. | 2 | 12 | FREMONT |
| 195974 | Well Constructed | KUEHL, ROBERT N | 2 | 12 | FREMONT |
| 198721 | Well Constructed | WILTSE DONALD CHARLES | 2 | 12 | FREMONT |
| 198714 | Well Constructed | EMBRY, DON J | 2 | 12 | FREMONT |
| 198722 | Well Constructed | WILTSE DONALD CHARLES | 2 | 12 | FREMONT |
| 198715 | Well Constructed | BEDFORD RUSSELL & SHARON LEE | 2 | 12 | FREMONT |
| 198155 | Well Constructed | MOSER MICHAEL & SWENSUN PHYLLIS | 2 | 12 | FREMONT |
| 198713 | Well Constructed | BAXTER, PAUL | 2 | 12 | FREMONT |
| 202223 | Well Constructed | ROBINSON, SAMUEL G | 2 | 12 | FREMONT |
| 203262 | Well Constructed | SHIPPEY, RONALD | 2 | 12 | FREMONT |
| 207552 | Well Constructed | MILLS ART & PATRICIA | 2 | 12 | FREMONT |
| 208605 | Well Constructed | COOPER DONALD E & MARTHA J | 2 | 12 | FREMONT |
| 213831 | Well Constructed | LESKOSKY, BERNICE P | 2 | 12 | FREMONT |
| 213835 | Well Constructed | MARCHAND GARY JOANN & HELEN | 2 | 12 | FREMONT |
| 213832 | Well Constructed | LESKOSKY, BERNICE P | 2 | 12 | FREMONT |
| 215223 | Well Constructed | BAUM, DOUGLAS W | 2 | 12 | FREMONT |
| 198714-A | Well Constructed | IGLESIAS, FIDEL | 2 | 12 | FREMONT |
| 215395 | Well Constructed | DYE, WILLIAM E | 2 | 12 | FREMONT |
| 215222 | Well Constructed | GARETT, CAROL M | 2 | 12 | FREMONT |
| 215394 | Well Constructed | BRADSHAW DEAN & PATRICIA | 2 | 12 | FREMONT |
| 215218 | Well Constructed | BEAN, KEITH D | 2 | 12 | FREMONT |
| 217453 | Well Constructed | AMMEL HARVEY D & DEANNA L | 2 | 12 | FREMONT |
| 221113 | Well Constructed | KEELER, JOHN | 2 | 12 | FREMONT |

| Permit | Current Status | Contact Name | DIV | WD | County |
|---|---|---|---|---|---|
| 233827 | Well Constructed | CROSBY, JACKIE | 2 | 12 | FREMONT |
| 235767 | Well Constructed | NORHOLM, COLLEEN | 2 | 12 | FREMONT |
| 237077 | Well Constructed | SCHOMCKER DENNIS & KATHLEEN | 2 | 12 | FREMONT |
| 238087 | Well Constructed | HEYEN RON & JEANETTE | 2 | 12 | FREMONT |
| 239701 | Well Constructed | ASQUITH, JOHN | 2 | 12 | FREMONT |
| 239701 | Well Constructed | CARROLL, JANICE | 2 | 12 | FREMONT |
| 46052F-R | Well Replaced | CAMP SCHIRADO LLC | 2 | 12 | FREMONT |
| 258919 | Well Constructed | SIMS JONATHAN M & PASLEY WHITNEY N | 2 | 12 | FREMONT |
| 260350 | Well Constructed | MARCHAND RANCH | 2 | 12 | FREMONT |
| 43342-A | Well Constructed | WILLIAMS, BLAIR | 2 | 12 | FREMONT |
| 270239 | Well Constructed | TATUM MATTHEW C & KATIA | 2 | 12 | FREMONT |
| 275470 | Well Constructed | LYNN, STUART C. | 2 | 12 | FREMONT |
| 275470 | Well Constructed | LYNN, SALLY J. | 2 | 12 | FREMONT |
| 276232 | Well Constructed | LEWIS-MARTIN, CLAIRE | 2 | 12 | FREMONT |
| 215983-A | Well Constructed | CLARK, JAMES | 2 | 12 | FREMONT |
| 287455 | Well Constructed | PHILLIPS, MICHAEL F | 2 | 12 | FREMONT |
| 290267 | Well Constructed | ELDRED JACQUE & MARKUS | 2 | 12 | FREMONT |
| 292021 | Well Constructed | CHALMERS HUGH & ROXANE | 2 | 12 | FREMONT |
| 78822F | Well Constructed | FRONT RANGE AGGREGATES LLC | 2 | 12 | FREMONT |
| 300506 | Well Constructed | BARGER, TROY C | 2 | 12 | FREMONT |
| 301600 | Well Replaced | FEDIE, MARK | 2 | 12 | FREMONT |
| 301597 | Well Constructed | TABISH MARK & WENDY | 2 | 12 | FREMONT |
| 301601 | Well Constructed | FEDIE, MARK | 2 | 12 | FREMONT |
| 301598 | Well Constructed | SANDERS, JAMES W. | 2 | 12 | FREMONT |
| 301603 | Well Constructed | FEDIE, MARK | 2 | 12 | FREMONT |
| 301598 | Well Constructed | SANDERS, NANCY | 2 | 12 | FREMONT |
| 301600-A | Well Constructed | CABAY, HEATHER L. | 2 | 12 | FREMONT |
| 301600-A | Well Constructed | CABAY, JASON J. | 2 | 12 | FREMONT |
| 144365 | Well Constructed | ALVIES, DIANE | 2 | 12 | FREMONT |
| 44904 | Well Constructed | MASSEY, JAN E | 2 | 12 | FREMONT |
| 21556 | Well Constructed | FREDICKSON WALKER & BOMBERG | 2 | 12 | FREMONT |
| 10350 | Well Constructed | GOWDY, BENITA F | 2 | 12 | FREMONT |
| 44202 | Well Constructed | TYLER, ROGER | 2 | 12 | FREMONT |
| 8568 | Well Constructed | BARTGIS KELLY D & PAMELA J | 2 | 12 | FREMONT |
| 47740 | Well Constructed | CF&I STEEL CORPORATION | 2 | 12 | FREMONT |
| 39396 | Well Constructed | MASSEY, JAN E | 2 | 12 | FREMONT |
| 43341 | Well Constructed | CF & I STEEL CORP | 2 | 12 | FREMONT |
| 43342 | Well Constructed | CF & I STEEL CORP | 2 | 12 | FREMONT |
| 55817 | Well Constructed | MOUNT, IMOGEAN | 2 | 12 | FREMONT |
| 108315 | Well Constructed | BARTGIS KELLY D & PAMELA D | 2 | 12 | FREMONT |
| 60502 | Well Constructed | STEWART, LEONARD | 2 | 12 | FREMONT |
| 68659 | Well Constructed | WINKIEWICZ, FRANK | 2 | 12 | FREMONT |
| 304787 | Well Constructed | CAIN, DANIEL E | 2 | 12 | FREMONT |
| 46052F-R | Well Constructed | SCHIRADO, RHONDA J. | 2 | 12 | FREMONT |
| 305825 | Well Constructed | BARRY, KENNETH J. | 2 | 12 | FREMONT |
| 269359 | Well Constructed | OWENS RICHARD W & KRISTY ANN | 2 | 12 | FREMONT |

| Permit | Current Status | Contact Name | DIV | WD | County |
|---|---|---|---|---|---|
| 301599 | Well Constructed | HOUDEK, GRETCHEN | 2 | 12 | FREMONT |
| 198720 | Well Constructed | ANDERSON, DONALD | 2 | 12 | FREMONT |
| 198720 | Well Constructed | SLEZAK, SUSAN | 2 | 12 | FREMONT |
| 269113 | Well Constructed | ALVIES, DIANE | 2 | 12 | FREMONT |
| 312799 | Well Constructed | PARKER, CHRISTOPHER A. | 2 | 12 | FREMONT |

| Permit | Designated Basin | Management District | Denver Basin Aquifer | PM | Township | Range |
|---|---|---|---|---|---|---|
| 25221MH | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 30210MH | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 78124 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 88822 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 140871-A | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 145102 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 153943 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 43341-A | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 153943 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 155081 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 155081-A | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 155379 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 47740-A | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 159430 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 162121 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 168370 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 174707 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 177783 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 192134 | <Null> | <Null> | No | S | 17.0 S | 71.0 W |
| 46051F | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 194842 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 194843 | <Null> | <Null> | No | S | 17.0 S | 71.0 W |
| 194841 | <Null> | <Null> | No | S | 17.0 S | 71.0 W |
| 194841 | <Null> | <Null> | No | S | 17.0 S | 71.0 W |
| 195974 | <Null> | <Null> | No | S | 17.0 S | 71.0 W |
| 198721 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 198714 | <Null> | <Null> | No | S | 17.0 S | 71.0 W |
| 198722 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 198715 | <Null> | <Null> | No | S | 17.0 S | 71.0 W |
| 198155 | <Null> | <Null> | No | S | 17.0 S | 71.0 W |
| 198713 | <Null> | <Null> | No | S | 17.0 S | 71.0 W |
| 202223 | <Null> | <Null> | No | S | 17.0 S | 71.0 W |
| 203262 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 207552 | <Null> | <Null> | No | S | 17.0 S | 71.0 W |
| 208605 | <Null> | <Null> | No | S | 18.0 S | 72.0 W |
| 213831 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 213835 | <Null> | <Null> | No | S | 17.0 S | 72.0 W |
| 213832 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 215223 | <Null> | <Null> | No | S | 17.0 S | 71.0 W |
| 198714-A | <Null> | <Null> | No | S | 17.0 S | 71.0 W |
| 215395 | <Null> | <Null> | No | S | 17.0 S | 71.0 W |
| 215222 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 215394 | <Null> | <Null> | No | S | 17.0 S | 71.0 W |
| 215218 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 217453 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 221113 | <Null> | <Null> | No | S | 17.0 S | 72.0 W |

| Permit | Designated Basin | Management District | Denver Basin Aquifer | PM | Township | Range |
|---|---|---|---|---|---|---|
| 233827 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 235767 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 237077 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 238087 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 239701 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 239701 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 46052F-R | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 258919 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 260350 | <Null> | <Null> | No | S | 17.0 S | 72.0 W |
| 43342-A | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 270239 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 275470 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 275470 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 276232 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 215983-A | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 287455 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 290267 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 292021 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 78822F | <Null> | <Null> | No | S | 18.0 S | 72.0 W |
| 300506 | <Null> | <Null> | No | S | 17.0 S | 72.0 W |
| 301600 | <Null> | <Null> | No | S | 17.0 S | 72.0 W |
| 301597 | <Null> | <Null> | No | S | 17.0 S | 72.0 W |
| 301601 | <Null> | <Null> | No | S | 17.0 S | 72.0 W |
| 301598 | <Null> | <Null> | No | S | 17.0 S | 72.0 W |
| 301603 | <Null> | <Null> | No | S | 17.0 S | 72.0 W |
| 301598 | <Null> | <Null> | No | S | 17.0 S | 72.0 W |
| 301600-A | <Null> | <Null> | No | S | 17.0 S | 72.0 W |
| 301600-A | <Null> | <Null> | No | S | 17.0 S | 72.0 W |
| 144365 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 44904 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 21556 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 10350 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 44202 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 8568 | <Null> | <Null> | No | S | 17.0 S | 72.0 W |
| 47740 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 39396 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 43341 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 43342 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 55817 | <Null> | <Null> | No | S | 17.0 S | 71.0 W |
| 108315 | <Null> | <Null> | No | S | 17.0 S | 72.0 W |
| 60502 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 68659 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 304787 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 46052F-R | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 305825 | <Null> | <Null> | No | S | 17.0 S | 72.0 W |
| 269359 | <Null> | <Null> | No | S | 17.0 S | 71.0 W |

| Permit | Designated Basin | Management District | Denver Basin Aquifer | PM | Township | Range |
|---|---|---|---|---|---|---|
| 301599 | <Null> | <Null> | No | S | 17.0 S | 72.0 W |
| 198720 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 198720 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 269113 | <Null> | <Null> | No | S | 18.0 S | 71.0 W |
| 312799 | <Null> | <Null> | No | S | 17.0 S | 72.0 W |

| Permit | Township_D | Range_D | Section | Q10 | Q40 | Q160 | CoordsEW | CoordsEW Dir | CoordsNS |
|---|---|---|---|---|---|---|---|---|---|
| 25221MH | -18 | -71 | 8 | <Null> | NE | NE | <Null> | <Null> | <Null> |
| 30210MH | -18 | -71 | 8 | <Null> | SW | NE | <Null> | <Null> | <Null> |
| 78124 | -18 | -71 | 8 | <Null> | SE | SE | 16 | E | 150 |
| 88822 | -18 | -71 | 5 | <Null> | SE | SE | 1086 | E | 1150 |
| 140871-A | -18 | -71 | 5 | <Null> | SE | SE | 900 | E | 500 |
| 145102 | -18 | -71 | 8 | <Null> | SE | NE | 300 | E | 2600 |
| 153943 | -18 | -71 | 5 | <Null> | NW | SW | 2170 | W | 1740 |
| 43341-A | -18 | -71 | 7 | <Null> | SE | SW | 4224 | E | 3960 |
| 153943 | -18 | -71 | 5 | <Null> | NW | SW | 2170 | W | 1740 |
| 155081 | -18 | -71 | 9 | <Null> | SW | NW | 600 | W | 1800 |
| 155081-A | -18 | -71 | 9 | <Null> | SW | NW | 760 | W | 2080 |
| 155379 | -18 | -71 | 17 | <Null> | NW | SE | 2900 | W | 3500 |
| 47740-A | -18 | -71 | 7 | <Null> | SW | SW | 890 | W | 1040 |
| 159430 | -18 | -71 | 9 | <Null> | SW | SW | 500 | W | 1000 |
| 162121 | -18 | -71 | 8 | <Null> | SW | SW | 1100 | W | 100 |
| 168370 | -18 | -71 | 17 | <Null> | SE | SE | 660 | E | 660 |
| 174707 | -18 | -71 | 17 | <Null> | SE | NE | 845 | E | 1745 |
| 177783 | -18 | -71 | 8 | <Null> | SE | NE | 150 | E | 1450 |
| 192134 | -17 | -71 | 32 | <Null> | NW | SW | 900 | W | 1520 |
| 46051F | -18 | -71 | 8 | <Null> | NE | NE | 400 | E | 1300 |
| 194842 | -18 | -71 | 6 | <Null> | NE | NE | 400 | E | 800 |
| 194843 | -17 | -71 | 31 | <Null> | SE | SE | 400 | E | 200 |
| 194841 | -17 | -71 | 31 | <Null> | SE | SW | 2500 | W | 1162 |
| 194841 | -17 | -71 | 31 | <Null> | SE | SW | 2500 | W | 1162 |
| 195974 | -17 | -71 | 32 | <Null> | NW | SW | 800 | W | 1400 |
| 198721 | -18 | -71 | 6 | <Null> | NE | NW | 1850 | <Null> | 450 |
| 198714 | -17 | -71 | 31 | <Null> | SW | NW | 1250 | W | 2050 |
| 198722 | -18 | -71 | 6 | <Null> | NE | NW | 2300 | W | 450 |
| 198715 | -17 | -71 | 31 | <Null> | SW | NW | 400 | W | 2050 |
| 198155 | -17 | -71 | 31 | <Null> | NE | SW | 2200 | W | 2300 |
| 198713 | -17 | -71 | 31 | <Null> | NW | SE | 2850 | W | 1600 |
| 202223 | -17 | -71 | 32 | <Null> | SW | SW | 500 | W | 100 |
| 203262 | -18 | -71 | 8 | <Null> | SW | NE | 1600 | E | 2000 |
| 207552 | -17 | -71 | 30 | <Null> | SW | SW | 1000 | W | 100 |
| 208605 | -18 | -72 | 11 | <Null> | SE | SE | 530 | E | 725 |
| 213831 | -18 | -71 | 17 | <Null> | NE | SE | 850 | E | 2550 |
| 213835 | -17 | -72 | 26 | <Null> | SE | SE | 400 | E | 1120 |
| 213832 | -18 | -71 | 17 | <Null> | NE | SE | 660 | E | 1980 |
| 215223 | -17 | -71 | 31 | <Null> | SW | SE | 2000 | E | 800 |
| 198714-A | -17 | -71 | 31 | <Null> | SW | NW | 1070 | W | 1640 |
| 215395 | -17 | -71 | 31 | <Null> | NW | SW | 1100 | W | 1600 |
| 215222 | -18 | -71 | 6 | <Null> | NW | NW | 500 | W | 550 |
| 215394 | -17 | -71 | 31 | <Null> | NW | SW | 525 | W | 1550 |
| 215218 | -18 | -71 | 6 | <Null> | NW | NW | 200 | W | 550 |
| 217453 | -18 | -71 | 6 | <Null> | NW | NE | 1910 | E | 390 |
| 221113 | -17 | -72 | 25 | <Null> | SE | SW | 2400 | W | 1000 |

| Permit | Township_D | Range_D | Section | Q10 | Q40 | Q160 | CoordsEW | CoordsEW Dir | CoordsNS |
|---|---|---|---|---|---|---|---|---|---|
| 233827 | -18 | -71 | 5 | <Null> | NE | SW | 1200 | W | 2700 |
| 235767 | -18 | -71 | 8 | <Null> | NW | NE | 1980 | E | 660 |
| 237077 | -18 | -71 | 5 | <Null> | SE | SW | 2400 | W | 450 |
| 238087 | -18 | -71 | 8 | <Null> | NW | NW | 525 | W | 375 |
| 239701 | -18 | -71 | 5 | <Null> | SE | SW | 1500 | W | 1050 |
| 239701 | -18 | -71 | 5 | <Null> | SE | SW | 1500 | W | 1050 |
| 46052F-R | -18 | -71 | 8 | <Null> | NE | NE | 59 | E | 169 |
| 258919 | -18 | -71 | 5 | <Null> | SW | SE | 2025 | E | 900 |
| 260350 | -17 | -72 | 26 | <Null> | NW | SW | 854 | W | 85 |
| 43342-A | -18 | -71 | 18 | <Null> | NW | NE | 2415 | E | 10 |
| 270239 | -18 | -71 | 4 | <Null> | SW | NW | 336 | W | 546 |
| 275470 | -18 | -71 | 5 | <Null> | NE | NE | 26 | E | 646 |
| 275470 | -18 | -71 | 5 | <Null> | NE | NE | 26 | E | 646 |
| 276232 | -18 | -71 | 8 | <Null> | NW | NW | 582 | W | 321 |
| 215983-A | -18 | -71 | 7 | <Null> | NE | SE | 749 | E | 2383 |
| 287455 | -18 | -71 | 8 | <Null> | NW | NE | 1814 | E | 1055 |
| 290267 | -18 | -71 | 8 | <Null> | NW | SE | 2043 | E | 1481 |
| 292021 | -18 | -71 | 5 | <Null> | SE | SE | 850 | E | 900 |
| 78822F | -18 | -72 | 12 | <Null> | SE | SW | 1744 | W | 672 |
| 300506 | -17 | -72 | 36 | <Null> | NE | NW | 1377 | W | 739 |
| 301600 | -17 | -72 | 36 | <Null> | SE | NE | 960 | E | 2438 |
| 301597 | -17 | -72 | 36 | <Null> | <Null> | <Null> | 2595 | W | 2305 |
| 301601 | -17 | -72 | 36 | <Null> | <Null> | <Null> | 1176 | E | 2059 |
| 301598 | -17 | -72 | 36 | <Null> | <Null> | <Null> | 2589 | E | 1514 |
| 301603 | -17 | -72 | 36 | <Null> | NW | SE | 1935 | E | 2162 |
| 301598 | -17 | -72 | 36 | <Null> | <Null> | <Null> | 2589 | E | 1514 |
| 301600-A | -17 | -72 | 36 | <Null> | <Null> | <Null> | <Null> | <Null> | <Null> |
| 301600-A | -17 | -72 | 36 | <Null> | <Null> | <Null> | <Null> | <Null> | <Null> |
| 144365 | -18 | -71 | 17 | <Null> | NW | NE | 1625 | E | 400 |
| 44904 | -18 | -71 | 8 | <Null> | NE | NE | 600 | E | 100 |
| 21556 | -18 | -71 | 17 | <Null> | NE | NW | <Null> | <Null> | <Null> |
| 10350 | -18 | -71 | 5 | <Null> | NE | NE | 1041 | W | 185 |
| 44202 | -18 | -71 | 8 | <Null> | NE | NE | <Null> | <Null> | <Null> |
| 8568 | -17 | -72 | 26 | <Null> | SE | SW | <Null> | <Null> | <Null> |
| 47740 | -18 | -71 | 7 | <Null> | SW | SW | 2090 | W | 500 |
| 39396 | -18 | -71 | 8 | <Null> | NE | NE | 372 | E | 100 |
| 43341 | -18 | -71 | 7 | <Null> | SE | SW | 2360 | W | 280 |
| 43342 | -18 | -71 | 18 | <Null> | NW | NE | 2530 | E | 140 |
| 55817 | -17 | -71 | 31 | <Null> | NE | SE | <Null> | <Null> | <Null> |
| 108315 | -17 | -72 | 34 | <Null> | NE | NE | 50 | E | 800 |
| 60502 | -18 | -71 | 8 | <Null> | NE | SE | <Null> | <Null> | <Null> |
| 68659 | -18 | -71 | 5 | <Null> | SE | SE | 570 | E | 310 |
| 304787 | -18 | -71 | 5 | <Null> | NW | NE | <Null> | <Null> | <Null> |
| 46052F-R | -18 | -71 | 8 | <Null> | NE | NE | <Null> | <Null> | <Null> |
| 305825 | -17 | -72 | 36 | <Null> | NW | SE | <Null> | <Null> | <Null> |
| 269359 | -17 | -71 | 31 | <Null> | SW | NW | <Null> | <Null> | <Null> |

| Permit | Township_D | Range_D | Section | Q10 | Q40 | Q160 | CoordsEW | CoordsEW Dir | CoordsNS |
|---|---|---|---|---|---|---|---|---|---|
| 301599 | -17 | -72 | 36 | <Null> | SE | SW | <Null> | <Null> | <Null> |
| 198720 | -18 | -71 | 6 | <Null> | NE | NW | <Null> | <Null> | <Null> |
| 198720 | -18 | -71 | 6 | <Null> | NE | NW | <Null> | <Null> | <Null> |
| 269113 | -18 | -71 | 17 | <Null> | NW | NE | <Null> | <Null> | <Null> |
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| Permit | CoordsNS Dir | UTM x | UTM y | Latitude | Longitude | Location Accuracy |
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| 30210MH | <Null> | 469146.6 | 4261050.6 | 38.497277 | -105.353818 | Spotted from quarters |
| 78124 | S | 469751.4 | 4260092 | 38.488659 | -105.346841 | Spotted from section lines |
| 88822 | S | 469316.4 | 4262008 | 38.505911 | -105.351913 | Spotted from section lines |
| 140871-A | S | 469385.4 | 4261812.1 | 38.504148 | -105.351113 | Spotted from section lines |
| 145102 | N | 469621.5 | 4260873.6 | 38.495698 | -105.348365 | Spotted from section lines |
| 153943 | S | 468893.2 | 4262176.6 | 38.507416 | -105.356774 | Spotted from section lines |
| 43341-A | N | 466965.9 | 4260396.1 | 38.491301 | -105.378794 | Spotted from section lines |
| 153943 | S | 468893.2 | 4262176.6 | 38.507416 | -105.356774 | Spotted from section lines |
| 155081 | N | 469882.1 | 4261126.1 | 38.497983 | -105.345387 | Spotted from section lines |
| 155081-A | N | 469935.6 | 4261043.1 | 38.497237 | -105.34477 | Spotted from section lines |
| 155379 | N | 469198.2 | 4258982.1 | 38.478638 | -105.353135 | Spotted from section lines |
| 47740-A | S | 466964.3 | 4260310.1 | 38.490526 | -105.378809 | Spotted from section lines |
| 159430 | S | 469894.3 | 4260352.6 | 38.491012 | -105.345214 | Spotted from section lines |
| 162121 | S | 468607.2 | 4260077.1 | 38.488485 | -105.35996 | Spotted from section lines |
| 168370 | S | 469676.9 | 4258639.6 | 38.475568 | -105.347633 | Spotted from section lines |
| 174707 | N | 469546.1 | 4259516.1 | 38.483462 | -105.34917 | Spotted from section lines |
| 177783 | N | 469647.8 | 4261224.6 | 38.498862 | -105.348078 | Spotted from section lines |
| 192134 | S | 468571.6 | 4263644 | 38.52063 | -105.360529 | Spotted from section lines |
| 46051F | N | 469569.2 | 4261268.1 | 38.499252 | -105.348981 | Spotted from section lines |
| 194842 | N | 468172.4 | 4262925.1 | 38.514136 | -105.365075 | Spotted from section lines |
| 194843 | S | 468189.8 | 4263233.1 | 38.516912 | -105.36489 | Spotted from section lines |
| 194841 | S | 466979.5 | 4263523.1 | 38.519481 | -105.378786 | Spotted from section lines |
| 194841 | S | 466979.5 | 4263523.1 | 38.519481 | -105.378786 | Spotted from section lines |
| 195974 | S | 468542.5 | 4263606.6 | 38.520291 | -105.360861 | Spotted from section lines |
| 198721 | N | 467283.4 | 4262946.5 | 38.514296 | -105.375273 | User supplied |
| 198714 | N | 466610 | 4264114.6 | 38.524798 | -105.383053 | Spotted from section lines |
| 198722 | N | 467376.8 | 4263005.6 | 38.514832 | -105.374205 | Spotted from section lines |
| 198715 | N | 466350.9 | 4264111.6 | 38.524761 | -105.386025 | Spotted from section lines |
| 198155 | S | 466894.8 | 4263869.6 | 38.522601 | -105.379774 | Spotted from section lines |
| 198713 | S | 467088.8 | 4263657.1 | 38.520693 | -105.377539 | Spotted from section lines |
| 202223 | S | 468465.1 | 4263207.6 | 38.516692 | -105.361731 | Spotted from section lines |
| 203262 | N | 469215.5 | 4261046.1 | 38.497239 | -105.353028 | Spotted from section lines |
| 207552 | S | 466546.7 | 4264769.1 | 38.530694 | -105.38381 | Spotted from section lines |
| 208605 | N | 464881.6 | 4261476.6 | 38.500958 | -105.402748 | Spotted from section lines |
| 213831 | S | 469570.2 | 4259214 | 38.480741 | -105.348881 | Spotted from section lines |
| 213835 | S | 464497.9 | 4265099.1 | 38.533589 | -105.407333 | Spotted from section lines |
| 213832 | S | 469642.9 | 4259041.1 | 38.479185 | -105.34804 | Spotted from section lines |
| 215223 | S | 467695.6 | 4263414.6 | 38.51853 | -105.370567 | Spotted from section lines |
| 198714-A | N | 466557.6 | 4264239.1 | 38.525918 | -105.38366 | Spotted from section lines |
| 215395 | S | 466555.4 | 4263655.6 | 38.52066 | -105.383657 | Spotted from section lines |
| 215222 | N | 466827.8 | 4262957 | 38.514375 | -105.380499 | Spotted from section lines |
| 215394 | S | 466379.9 | 4263640.1 | 38.520513 | -105.38567 | Spotted from section lines |
| 215218 | N | 466736.4 | 4262954.1 | 38.514345 | -105.381548 | Spotted from section lines |
| 217453 | N | 467722.4 | 4263035.1 | 38.515111 | -105.370242 | Spotted from section lines |
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| Permit | CoordsNS Dir | UTM x | UTM y | Latitude | Longitude | Location Accuracy |
|---|---|---|---|---|---|---|
| 233827 | N | 468613.3 | 4262362.6 | 38.509082 | -105.359993 | Spotted from section lines |
| 235767 | N | 469077 | 4261451.1 | 38.500884 | -105.354634 | Spotted from section lines |
| 237077 | S | 468931.7 | 4261785.6 | 38.503894 | -105.356315 | Spotted from section lines |
| 238087 | N | 468355.4 | 4261520.1 | 38.501481 | -105.362913 | Spotted from section lines |
| 239701 | S | 468672.2 | 4261961.1 | 38.505466 | -105.359299 | Spotted from section lines |
| 239701 | S | 468672.2 | 4261961.1 | 38.505466 | -105.359299 | Spotted from section lines |
| 46052F-R | N | 469654 | 4261615.1 | 38.502382 | -105.348024 | Spotted from section lines |
| 258919 | S | 469035 | 4261925 | 38.505153 | -105.355137 | Spotted from section lines |
| 260350 | S | 463251.8 | 4264804.5 | 38.530883 | -105.421614 | Spotted from section lines |
| 43342-A | N | 467538.3 | 4260013.5 | 38.487873 | -105.372213 | Spotted from section lines |
| 270239 | N | 469685.1 | 4263054 | 38.51535 | -105.34773 | Spotted from section lines |
| 275470 | N | 469577 | 4263013 | 38.51498 | -105.34897 | User supplied |
| 275470 | N | 469577 | 4263013 | 38.51498 | -105.34897 | User supplied |
| 276232 | N | 468371.9 | 4261537 | 38.50163 | -105.36272 | Spotted from section lines |
| 215983-A | S | 468007 | 4260763 | 38.494645 | -105.366873 | Spotted from section lines |
| 287455 | N | 469134.3 | 4261332 | 38.499813 | -105.353972 | Spotted from section lines |
| 290267 | S | 469110.9 | 4260497.5 | 38.492291 | -105.354203 | Spotted from section lines |
| 292021 | S | 469393.1 | 4261934 | 38.505246 | -105.35103 | Spotted from section lines |
| 78822F | S | 465546.7 | 4260255.8 | 38.489983 | -105.395061 | User supplied |
| 300506 | N | 465037 | 4264525 | 38.528436 | -105.401119 | User supplied |
| 301600 | N | 465934.2 | 4263996 | 38.523704 | -105.3908 | Spotted from section lines |
| 301597 | N | 465393.8 | 4264043 | 38.524106 | -105.397001 | Spotted from section lines |
| 301601 | S | 465864.5 | 4263795.5 | 38.521894 | -105.39159 | Spotted from section lines |
| 301598 | S | 465430.6 | 4263630.5 | 38.520391 | -105.396559 | Spotted from section lines |
| 301603 | S | 465633.7 | 4263827.5 | 38.522174 | -105.394239 | Spotted from section lines |
| 301598 | S | 465430.6 | 4263630.5 | 38.520391 | -105.396559 | Spotted from section lines |
| 301600-A | <Null> | 465418 | 4263957 | 38.523332 | -105.39672 | Spotted from quarters |
| 301600-A | <Null> | 465418 | 4263957 | 38.523332 | -105.39672 | Spotted from quarters |
| 144365 | N | 469273.7 | 4259925.1 | 38.487139 | -105.352311 | Spotted from section lines |
| 44904 | N | 469488 | 4261632.1 | 38.502529 | -105.349929 | Spotted from section lines |
| 21556 | <Null> | 468841.6 | 4259847.1 | 38.486421 | -105.357262 | Spotted from quarters |
| 10350 | N | 468626.5 | 4263126.5 | 38.51597 | -105.35988 | Spotted from section lines |
| 44202 | <Null> | 469494.8 | 4261460.6 | 38.500984 | -105.349843 | Spotted from quarters |
| 8568 | <Null> | 463604.7 | 4264973.6 | 38.532422 | -105.417574 | Spotted from quarters |
| 47740 | S | 467335.5 | 4260161 | 38.489196 | -105.374545 | Spotted from section lines |
| 39396 | N | 469557.5 | 4261633.6 | 38.502545 | -105.349132 | Spotted from section lines |
| 43341 | S | 467420 | 4260097.1 | 38.488623 | -105.373574 | Spotted from section lines |
| 43342 | N | 467504.7 | 4259972.6 | 38.487504 | -105.372597 | Spotted from section lines |
| 55817 | <Null> | 468111.8 | 4263759.6 | 38.521654 | -105.365808 | Spotted from quarters |
| 108315 | N | 462985.3 | 4264539.6 | 38.528485 | -105.424657 | Spotted from section lines |
| 60502 | <Null> | 469539.3 | 4260652.6 | 38.493704 | -105.349298 | Spotted from quarters |
| 68659 | S | 469489.6 | 4261756.5 | 38.503651 | -105.349916 | Spotted from section lines |
| 304787 | <Null> | 468901 | 4263025 | 38.515068 | -105.356732 | GPS |
| 46052F-R | <Null> | 469654 | 4261615 | 38.502387 | -105.348034 | GPS |
| 305825 | <Null> | 465478 | 4263918 | 38.522989 | -105.396039 | GPS |
| 269359 | <Null> | 466860.3 | 4264288.5 | 38.526376 | -105.380203 | User supplied |

| Permit | CoordsNS Dir | UTM x | UTM y | Latitude | Longitude | Location Accuracy |
|---|---|---|---|---|---|---|
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| 198720 | <Null> | 467102.6 | 4262996.5 | 38.514742 | -105.377355 | User supplied |
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| 269113 | <Null> | 469244 | 4260003 | 38.487846 | -105.352665 | User supplied |
| 312799 | <Null> | 465271 | 4263730 | 38.521287 | -105.398405 | User supplied |

| Permit | Parcel Name | Address | City | State | Postal Code |
|---|---|---|---|---|---|
| 25221MH | <Null> | <Null> | <Null> | <Null> | <Null> |
| 30210MH | <Null> | <Null> | <Null> | <Null> | <Null> |
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| 88822 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 140871-A | CROWFOOT/NIMMO | <Null> | <Null> | <Null> | <Null> |
| 145102 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 153943 | <Null> | 321 COUNTY RD 353A | CANON CITY | CO | 81212 |
| 43341-A | <Null> | <Null> | <Null> | <Null> | <Null> |
| 153943 | <Null> | 321 COUNTY RD 353A | CANON CITY | CO | 81212 |
| 155081 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 155081-A | <Null> | <Null> | <Null> | <Null> | <Null> |
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| 159430 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 162121 | <Null> | <Null> | <Null> | <Null> | <Null> |
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| 192134 | KUEHL RANCHETTES | <Null> | <Null> | <Null> | <Null> |
| 46051F | <Null> | <Null> | <Null> | <Null> | <Null> |
| 194842 | CACTUS MOUNTAIN RANCH | <Null> | <Null> | <Null> | <Null> |
| 194843 | CACTUS MOUNTAIN RANCH | <Null> | <Null> | <Null> | <Null> |
| 194841 | CACTUS MOUNTAIN RANCH | <Null> | <Null> | <Null> | <Null> |
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| 195974 | KUEHL RANCHETTES | <Null> | <Null> | <Null> | <Null> |
| 198721 | CACTUS MOUNTAIN ESTATES | <Null> | <Null> | <Null> | <Null> |
| 198714 | CACTUS MOUNTAIN ESTATES | <Null> | <Null> | <Null> | <Null> |
| 198722 | CACTUS MOUNTAIN ESTATES | <Null> | <Null> | <Null> | <Null> |
| 198715 | CACTUS MOUNTAIN ESTATES | <Null> | <Null> | <Null> | <Null> |
| 198155 | CACTUS MOUNTAIN | <Null> | <Null> | <Null> | <Null> |
| 198713 | CACTUS MOUNTAIN ESTATES | <Null> | <Null> | <Null> | <Null> |
| 202223 | KUEHL RANCHETTES | <Null> | <Null> | <Null> | <Null> |
| 203262 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 207552 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 208605 | <Null> | <Null> | <Null> | <Null> | <Null> |
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| 213835 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 213832 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 215223 | CACTUS MOUNTAIN ESTATES | <Null> | <Null> | <Null> | <Null> |
| 198714-A | CACTUS MOUNTAIN ESTATES | <Null> | <Null> | <Null> | <Null> |
| 215395 | CACTUS MOUNTAIN ESTATES | <Null> | <Null> | <Null> | <Null> |
| 215222 | CACTUS MOUNTAIN ESTATES | <Null> | <Null> | <Null> | <Null> |
| 215394 | CACTUS MOUNTAIN ESTATES | <Null> | <Null> | <Null> | <Null> |
| 215218 | CACTUS MOUNTAIN ESTATES | <Null> | <Null> | <Null> | <Null> |
| 217453 | CACTUS MOUNTAIN ESTATES | <Null> | <Null> | <Null> | <Null> |
| 221113 | <Null> | 3700 STATE HWY 9 | CANON CITY | CO | 81212 |

| Permit | Parcel Name | Address | City | State | Postal Code |
|---|---|---|---|---|---|
| 233827 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 235767 | STAR RANCH | <Null> | <Null> | <Null> | <Null> |
| 237077 | STAR RANCH | <Null> | <Null> | <Null> | <Null> |
| 238087 | STAR RANCH | <Null> | <Null> | <Null> | <Null> |
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| 239701 | STAR RANCH | <Null> | <Null> | <Null> | <Null> |
| 46052F-R | <Null> | <Null> | <Null> | <Null> | <Null> |
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| 260350 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 43342-A | <Null> | <Null> | <Null> | <Null> | <Null> |
| 270239 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 275470 | <Null> | 1094 COUNTY ROAD 62 | CANYON CITY | CO | 81212 |
| 275470 | <Null> | 1094 COUNTY ROAD 62 | CANYON CITY | CO | 81212 |
| 276232 | STAR RANCH | <Null> | <Null> | <Null> | <Null> |
| 215983-A | <Null> | <Null> | <Null> | <Null> | <Null> |
| 287455 | STAR RANCH | <Null> | <Null> | <Null> | <Null> |
| 290267 | ROYAL GORGE BLUFFS | <Null> | <Null> | <Null> | <Null> |
| 292021 | CROWFOOT/NIMMO | <Null> | <Null> | <Null> | <Null> |
| 78822F | <Null> | <Null> | <Null> | <Null> | <Null> |
| 300506 | DOUBLE CREEK RANCH | <Null> | <Null> | <Null> | <Null> |
| 301600 | DOUBLE CREEK RANCH | <Null> | <Null> | <Null> | <Null> |
| 301597 | DOUBLE CREEK RANCH | <Null> | <Null> | <Null> | <Null> |
| 301601 | DOUBLE CREEK RANCH | <Null> | <Null> | <Null> | <Null> |
| 301598 | DOUBLE CREEK RANCH | <Null> | <Null> | <Null> | <Null> |
| 301603 | DOUBLE CREEK RANCH | <Null> | <Null> | <Null> | <Null> |
| 301598 | DOUBLE CREEK RANCH | <Null> | <Null> | <Null> | <Null> |
| 301600-A | DOUBLE CREEK RANCH | <Null> | <Null> | <Null> | <Null> |
| 301600-A | DOUBLE CREEK RANCH | <Null> | <Null> | <Null> | <Null> |
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| 44904 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 21556 | <Null> | <Null> | <Null> | <Null> | <Null> |
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| 44202 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 8568 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 47740 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 39396 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 43341 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 43342 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 55817 | <Null> | <Null> | <Null> | <Null> | <Null> |
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| 60502 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 68659 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 304787 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 46052F-R | <Null> | 43595 US HWY 50 | CANON CITY | CO | 81212 |
| 305825 | DOUBLE CREEK RANCH | <Null> | <Null> | <Null> | <Null> |
| 269359 | <Null> | 2520 STATE HWY 9 | CANON CITY | CO | 81212 |

| Permit | Parcel Name | Address | City | State | Postal Code |
|---|---|---|---|---|---|
| 301599 | DOUBLE CREEK RANCH | 1111 HORSESHOE DR | CANON CITY | CO | 81212 |
| 198720 | CACTUS MOUNTAIN ESTATES | 34 CACTUS DR W | CANON CITY | CO | 81212 |
| 198720 | CACTUS MOUNTAIN ESTATES | 34 CACTUS DR W | CANON CITY | CO | 81212 |
| 269113 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 312799 | DOUBLE CREEK RANCH | 38 DOUBLE CREEK RD | CANYON CITY | CO | 81212 |

| Permit | Location Type | Permit Category | Permit Issued |
|---|---|---|---|
| 25221MH | Well (Application/Permit) | Monitoring Hole (Notice of Intent) | 2/28/1995 |
| 30210MH | Well (Application/Permit) | Monitoring Hole (Notice of Intent) | 3/4/1997 |
| 78124 | Well (Application/Permit) | Residential | 2/20/1975 |
| 88822 | Well (Application/Permit) | Residential | 3/16/1977 |
| 140871-A | Well (Application/Permit) | Residential | 8/20/1985 |
| 145102 | Well (Application/Permit) | Residential | 8/25/1987 |
| 153943 | Well (Application/Permit) | Residential | 4/28/1989 |
| 43341-A | Well (Application/Permit) | Residential | 7/10/1989 |
| 153943 | Well (Application/Permit) | Residential | 4/28/1989 |
| 155081 | Well (Application/Permit) | Residential | 8/22/1989 |
| 155081-A | Well (Application/Permit) | Residential | 8/22/1989 |
| 155379 | Well (Application/Permit) | Residential | 9/22/1989 |
| 47740-A | Well (Application/Permit) | Residential | 5/30/1990 |
| 159430 | Well (Application/Permit) | Residential | 2/19/1991 |
| 162121 | Well (Application/Permit) | Residential | 10/23/1991 |
| 168370 | Well (Application/Permit) | Residential | 2/2/1993 |
| 174707 | Well (Application/Permit) | Residential | 11/19/1993 |
| 177783 | Well (Application/Permit) | Residential | 5/6/1994 |
| 192134 | Well (Application/Permit) | Residential | 12/27/1995 |
| 46051F | Well (Application/Permit) | General Purpose | 2/1/1996 |
| 194842 | Well (Application/Permit) | Residential | 5/9/1996 |
| 194843 | Well (Application/Permit) | Residential | 5/9/1996 |
| 194841 | Well (Application/Permit) | Residential | 5/9/1996 |
| 194841 | Well (Application/Permit) | Residential | 5/9/1996 |
| 195974 | Well (Application/Permit) | Residential | 6/24/1996 |
| 198721 | Well (Application/Permit) | Residential | 10/3/1996 |
| 198714 | Well (Application/Permit) | Residential | 10/3/1996 |
| 198722 | Well (Application/Permit) | Residential | 10/3/1996 |
| 198715 | Well (Application/Permit) | Residential | 10/3/1996 |
| 198155 | Well (Application/Permit) | Residential | 9/13/1996 |
| 198713 | Well (Application/Permit) | Residential | 10/3/1996 |
| 202223 | Well (Application/Permit) | Residential | 4/17/1997 |
| 203262 | Well (Application/Permit) | Residential | 6/11/1997 |
| 207552 | Well (Application/Permit) | Residential | 1/15/1998 |
| 208605 | Well (Application/Permit) | Residential | 3/17/1998 |
| 213831 | Well (Application/Permit) | Residential | 11/12/1998 |
| 213835 | Well (Application/Permit) | Residential | 11/12/1998 |
| 213832 | Well (Application/Permit) | Residential | 11/12/1998 |
| 215223 | Well (Application/Permit) | Residential | 1/20/1999 |
| 198714-A | Well (Application/Permit) | Residential | 2/11/1999 |
| 215395 | Well (Application/Permit) | Residential | 1/28/1999 |
| 215222 | Well (Application/Permit) | Residential | 1/20/1999 |
| 215394 | Well (Application/Permit) | Residential | 1/28/1999 |
| 215218 | Well (Application/Permit) | Residential | 1/20/1999 |
| 217453 | Well (Application/Permit) | Residential | 5/12/1999 |
| 221113 | Well (Application/Permit) | Residential | 10/8/1999 |

| Permit | Location Type | Permit Category | Permit Issued |
|---|---|---|---|
| 233827 | Well (Application/Permit) | Residential | 6/5/2001 |
| 235767 | Well (Application/Permit) | Residential | 8/28/2001 |
| 237077 | Well (Application/Permit) | Residential | 10/23/2001 |
| 238087 | Well (Application/Permit) | Residential | 12/4/2001 |
| 239701 | Well (Application/Permit) | Residential | 3/27/2002 |
| 239701 | Well (Application/Permit) | Residential | 3/27/2002 |
| 46052F-R | Well (Application/Permit) | General Purpose | 7/25/2003 |
| 258919 | Well (Application/Permit) | Residential | 8/27/2004 |
| 260350 | Well (Application/Permit) | Residential | 11/15/2004 |
| 43342-A | Well (Application/Permit) | Residential | 5/2/2006 |
| 270239 | Well (Application/Permit) | Residential | 8/21/2006 |
| 275470 | Well (Application/Permit) | Residential | 10/1/2007 |
| 275470 | Well (Application/Permit) | Residential | 10/1/2007 |
| 276232 | Well (Application/Permit) | Residential | 12/17/2007 |
| 215983-A | Well (Application/Permit) | Residential | 9/11/2009 |
| 287455 | Well (Application/Permit) | Residential | 2/1/2012 |
| 290267 | Well (Application/Permit) | Residential | 2/1/2013 |
| 292021 | Well (Application/Permit) | Residential | 7/22/2013 |
| 78822F | Well (Application/Permit) | Gravel Pit | 2/9/2015 |
| 300506 | Well (Application/Permit) | Residential | 3/18/2016 |
| 301600 | Well (Application/Permit) | Residential | 6/16/2016 |
| 301597 | Well (Application/Permit) | Residential | 6/16/2016 |
| 301601 | Well (Application/Permit) | Residential | 6/16/2016 |
| 301598 | Well (Application/Permit) | Residential | 6/16/2016 |
| 301603 | Well (Application/Permit) | Residential | 6/16/2016 |
| 301598 | Well (Application/Permit) | Residential | 6/16/2016 |
| 301600-A | Well (Application/Permit) | Residential | 1/26/2017 |
| 301600-A | Well (Application/Permit) | Residential | 1/26/2017 |
| 144365 | Well (Application/Permit) | Residential | <Null> |
| 44904 | Well (Application/Permit) | Residential | 3/18/1971 |
| 21556 | Well (Application/Permit) | Residential | <Null> |
| 10350 | Well (Application/Permit) | Residential | <Null> |
| 44202 | Well (Application/Permit) | Residential | <Null> |
| 8568 | Well (Application/Permit) | Residential | <Null> |
| 47740 | Well (Application/Permit) | Residential | <Null> |
| 39396 | Well (Application/Permit) | Residential | 9/22/1969 |
| 43341 | Well (Application/Permit) | Residential | <Null> |
| 43342 | Well (Application/Permit) | Residential | <Null> |
| 55817 | Well (Application/Permit) | Residential | 4/6/1972 |
| 108315 | Well (Application/Permit) | Residential | <Null> |
| 60502 | Well (Application/Permit) | Residential | 5/9/1972 |
| 68659 | Well (Application/Permit) | Residential | 5/1/1973 |
| 304787 | Well (Construction Report) | Residential | 3/9/2017 |
| 46052F-R | Well (Construction Report) | General Purpose | 7/12/2017 |
| 305825 | Well (Construction Report) | Residential | 6/19/2017 |
| 269359 | Well (Construction Report) | Residential | 6/14/2006 |

| Permit | Location Type | Permit Category | Permit Issued |
|---|---|---|---|
| 301599 | Well (Construction Report) | Residential | 6/16/2016 |
| 198720 | Well (Construction Report) | Residential | 10/3/1996 |
| 198720 | Well (Construction Report) | Residential | 10/3/1996 |
| 269113 | Well (Construction Report) | Residential | 5/30/2006 |
| 312799 | Well (Construction Report) | Residential | 3/15/2019 |

| Permit | First Beneficial Use | Permit Expires | Well Constructed | Pump Installed | Well Plugged |
|---|---|---|---|---|---|
| 25221MH | <Null> | 5/28/1995 | 3/14/1995 | <Null> | <Null> |
| 30210MH | <Null> | 6/4/1997 | 3/21/1997 | <Null> | <Null> |
| 78124 | <Null> | <Null> | 10/14/1975 | <Null> | <Null> |
| 88822 | 11/21/1967 | <Null> | <Null> | <Null> | <Null> |
| 140871-A | <Null> | 8/20/1987 | 10/8/1985 | 9/15/1995 | <Null> |
| 145102 | <Null> | <Null> | 9/22/1988 | <Null> | <Null> |
| 153943 | 1/15/1967 | <Null> | <Null> | <Null> | <Null> |
| 43341-A | <Null> | <Null> | 6/15/1989 | 6/16/1989 | <Null> |
| 153943 | 1/15/1967 | <Null> | <Null> | <Null> | <Null> |
| 155081 | 8/31/1954 | <Null> | <Null> | <Null> | <Null> |
| 155081-A | <Null> | <Null> | 6/15/1989 | 6/16/1989 | <Null> |
| 155379 | <Null> | 9/22/1991 | 10/21/1989 | <Null> | <Null> |
| 47740-A | <Null> | <Null> | 5/29/1990 | <Null> | <Null> |
| 159430 | <Null> | <Null> | 3/8/1991 | 5/12/1992 | <Null> |
| 162121 | <Null> | <Null> | 11/15/1992 | <Null> | <Null> |
| 168370 | <Null> | <Null> | 3/11/1993 | 8/17/1994 | <Null> |
| 174707 | <Null> | 11/19/1995 | <Null> | 1/4/1994 | <Null> |
| 177783 | <Null> | 5/6/1996 | 10/7/1993 | <Null> | <Null> |
| 192134 | <Null> | 12/27/1997 | 4/30/1996 | 5/30/1996 | <Null> |
| 46051F | 4/1/1996 | 2/1/1997 | 3/14/1995 | 3/10/1997 | <Null> |
| 194842 | <Null> | 5/9/1998 | 6/10/1996 | 5/18/1997 | <Null> |
| 194843 | <Null> | 5/9/1998 | 6/7/1996 | 2/28/1997 | <Null> |
| 194841 | <Null> | 5/9/1998 | 8/30/1996 | <Null> | <Null> |
| 194841 | <Null> | 5/9/1998 | 8/30/1996 | <Null> | <Null> |
| 195974 | <Null> | 6/24/1998 | 6/5/1996 | 7/1/1996 | <Null> |
| 198721 | <Null> | 10/3/1998 | 5/12/1997 | <Null> | <Null> |
| 198714 | <Null> | 10/3/1998 | 9/18/1998 | <Null> | <Null> |
| 198722 | <Null> | 10/3/1998 | <Null> | 10/20/1997 | <Null> |
| 198715 | <Null> | 10/3/1998 | 10/2/1998 | 10/19/1998 | <Null> |
| 198155 | <Null> | 9/13/1998 | 9/18/1996 | 4/19/1997 | <Null> |
| 198713 | <Null> | 10/3/1998 | 9/25/1998 | <Null> | <Null> |
| 202223 | <Null> | 4/17/1999 | <Null> | 6/10/1997 | <Null> |
| 203262 | <Null> | 6/11/1999 | 3/21/1997 | 7/16/2002 | <Null> |
| 207552 | 12/31/1950 | <Null> | 6/15/1968 | <Null> | <Null> |
| 208605 | 12/31/1960 | <Null> | 12/31/1960 | <Null> | <Null> |
| 213831 | <Null> | 11/12/2000 | 5/26/2000 | 6/23/2005 | <Null> |
| 213835 | 12/31/1936 | <Null> | <Null> | <Null> | <Null> |
| 213832 | <Null> | 11/12/2000 | 7/13/1987 | <Null> | <Null> |
| 215223 | <Null> | 1/20/2001 | 1/30/1999 | 3/16/1999 | <Null> |
| 198714-A | <Null> | 2/11/2001 | 2/13/1999 | 3/11/1999 | <Null> |
| 215395 | <Null> | 1/28/2001 | 2/2/1999 | 2/8/2002 | <Null> |
| 215222 | <Null> | 1/20/2001 | 1/28/1999 | 3/22/1999 | <Null> |
| 215394 | <Null> | 1/28/2001 | 2/1/1999 | 4/20/2000 | <Null> |
| 215218 | <Null> | 1/20/2001 | 1/29/1999 | 3/19/1999 | <Null> |
| 217453 | <Null> | 5/12/2001 | 4/6/1992 | <Null> | <Null> |
| 221113 | <Null> | 10/8/2001 | 11/9/1999 | <Null> | <Null> |

| Permit | First Beneficial Use | Permit Expires | Well Constructed | Pump Installed | Well Plugged |
|---|---|---|---|---|---|
| 233827 | <Null> | 6/5/2003 | 7/31/2001 | <Null> | <Null> |
| 235767 | <Null> | 8/28/2003 | 12/27/2001 | <Null> | <Null> |
| 237077 | <Null> | 10/23/2003 | 10/31/2001 | <Null> | <Null> |
| 238087 | <Null> | 12/4/2003 | 1/3/2002 | <Null> | <Null> |
| 239701 | <Null> | 3/27/2004 | 5/2/2002 | <Null> | <Null> |
| 239701 | <Null> | 3/27/2004 | 5/2/2002 | <Null> | <Null> |
| 46052F-R | <Null> | 7/25/2004 | 8/20/2003 | 8/24/2003 | <Null> |
| 258919 | <Null> | 8/27/2006 | 10/6/2004 | <Null> | <Null> |
| 260350 | <Null> | 11/15/2006 | 1/17/2005 | 1/21/2005 | <Null> |
| 43342-A | <Null> | 5/2/2008 | 7/14/2006 | <Null> | <Null> |
| 270239 | <Null> | 8/21/2008 | 10/10/2006 | 1/11/2007 | <Null> |
| 275470 | <Null> | 10/1/2009 | 1/16/2008 | 4/11/2008 | <Null> |
| 275470 | <Null> | 10/1/2009 | 1/16/2008 | 4/11/2008 | <Null> |
| 276232 | <Null> | 12/17/2009 | 1/8/2008 | 1/31/2008 | <Null> |
| 215983-A | <Null> | 9/11/2011 | 9/18/2009 | 9/24/2009 | <Null> |
| 287455 | <Null> | 2/1/2014 | 2/28/2012 | <Null> | <Null> |
| 290267 | <Null> | 2/1/2015 | 10/22/2013 | <Null> | <Null> |
| 292021 | <Null> | <Null> | 3/26/2004 | <Null> | <Null> |
| 78822F | <Null> | <Null> | 10/18/2004 | 12/4/2004 | <Null> |
| 300506 | <Null> | 3/18/2018 | 4/13/2016 | <Null> | <Null> |
| 301600 | <Null> | 6/16/2018 | 8/25/2016 | <Null> | 10/6/2016 |
| 301597 | <Null> | 6/16/2018 | 9/15/2016 | <Null> | <Null> |
| 301601 | <Null> | 6/16/2018 | 8/31/2016 | <Null> | <Null> |
| 301598 | <Null> | 6/16/2018 | 3/17/2017 | <Null> | <Null> |
| 301603 | <Null> | 6/16/2018 | 9/12/2016 | <Null> | <Null> |
| 301598 | <Null> | 6/16/2018 | 3/17/2017 | <Null> | <Null> |
| 301600-A | <Null> | 1/26/2019 | 3/15/2017 | <Null> | <Null> |
| 301600-A | <Null> | 1/26/2019 | 3/15/2017 | <Null> | <Null> |
| 144365 | 7/14/1986 | <Null> | <Null> | <Null> | <Null> |
| 44904 | <Null> | <Null> | <Null> | <Null> | <Null> |
| 21556 | 9/23/1964 | <Null> | <Null> | <Null> | <Null> |
| 10350 | 8/28/1961 | <Null> | <Null> | <Null> | <Null> |
| 44202 | 1/14/1971 | <Null> | <Null> | <Null> | <Null> |
| 8568 | 4/30/1961 | <Null> | <Null> | <Null> | <Null> |
| 47740 | 1/7/1947 | <Null> | 5/29/1990 | <Null> | <Null> |
| 39396 | 9/26/1969 | <Null> | 9/26/1969 | <Null> | <Null> |
| 43341 | 1/7/1947 | <Null> | <Null> | <Null> | <Null> |
| 43342 | 1/7/1972 | <Null> | <Null> | <Null> | <Null> |
| 55817 | 3/21/1974 | <Null> | 3/21/1974 | <Null> | <Null> |
| 108315 | 9/8/1979 | <Null> | <Null> | <Null> | <Null> |
| 60502 | 3/20/1973 | <Null> | 3/20/1973 | <Null> | <Null> |
| 68659 | 5/1/1973 | <Null> | 5/24/1973 | <Null> | <Null> |
| 304787 | <Null> | 3/9/2019 | 4/20/2017 | <Null> | <Null> |
| 46052F-R | <Null> | 7/12/2018 | 7/17/2017 | <Null> | <Null> |
| 305825 | <Null> | 6/19/2019 | 9/14/2017 | <Null> | <Null> |
| 269359 | <Null> | 6/14/2008 | 10/13/2006 | 3/28/2018 | <Null> |

| Permit | First Beneficial Use | Permit Expires | Well Constructed | Pump Installed | Well Plugged |
|---|---|---|---|---|---|
| 301599 | <Null> | 6/16/2018 | <Null> | 4/20/2018 | <Null> |
| 198720 | <Null> | 10/3/1998 | 5/12/1997 | 6/25/2018 | <Null> |
| 198720 | <Null> | 10/3/1998 | 5/12/1997 | 6/25/2018 | <Null> |
| 269113 | <Null> | 5/30/2008 | 6/8/2006 | 6/5/2019 | <Null> |
| 312799 | <Null> | 3/15/2021 | 6/27/2019 | 7/19/2019 | <Null> |

| Permit | Associated Aquifers | Associated Uses | Elevation | Well Depth |
|---|---|---|---|---|
| 25221MH | ALL UNNAMED AQUIFERS | Monitoring/Sampling | <Null> | 380 |
| 30210MH | ALL UNNAMED AQUIFERS | Monitoring/Sampling | <Null> | 380 |
| 78124 | ALL UNNAMED AQUIFERS | Stock | <Null> | 200 |
| 88822 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | <Null> |
| 140871-A | ALL UNNAMED AQUIFERS | Domestic | <Null> | <Null> |
| 145102 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | 350 |
| 153943 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | <Null> |
| 43341-A | ALL UNNAMED AQUIFERS | Domestic | <Null> | 80 |
| 153943 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | <Null> |
| 155081 | ALL UNNAMED AQUIFERS | Household use only | <Null> | 264 |
| 155081-A | ALL UNNAMED AQUIFERS | Household use only | <Null> | 247 |
| 155379 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 158 |
| 47740-A | ALL UNNAMED AQUIFERS | Domestic, Industrial | <Null> | 320 |
| 159430 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | 360 |
| 162121 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | 250 |
| 168370 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 300 |
| 174707 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 200 |
| 177783 | ALL UNNAMED AQUIFERS | Commercial | <Null> | 175 |
| 192134 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 175 |
| 46051F | ALL UNNAMED AQUIFERS | Domestic | <Null> | 380 |
| 194842 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | 395 |
| 194843 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | 475 |
| 194841 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | 475 |
| 194841 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | 475 |
| 195974 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 395 |
| 198721 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 300 |
| 198714 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 750 |
| 198722 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 300 |
| 198715 | ALL UNNAMED AQUIFERS | Domestic | 0 | 550 |
| 198155 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 125 |
| 198713 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 275 |
| 202223 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 225 |
| 203262 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | 380 |
| 207552 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 628 |
| 208605 | ALL UNNAMED AQUIFERS | Stock | <Null> | 110 |
| 213831 | ALL UNNAMED AQUIFERS | Household use only | <Null> | 550 |
| 213835 | ALL UNNAMED AQUIFERS | Stock | <Null> | <Null> |
| 213832 | ALL UNNAMED AQUIFERS | Household use only | <Null> | 300 |
| 215223 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 550 |
| 198714-A | ALL UNNAMED AQUIFERS | Domestic | <Null> | 350 |
| 215395 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 600 |
| 215222 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 700 |
| 215394 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 350 |
| 215218 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 675 |
| 217453 | ALL UNNAMED AQUIFERS | Domestic, Storage | <Null> | 335 |
| 221113 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | 32 |

| Permit | Associated Aquifers | Associated Uses | Elevation | Well Depth |
|---|---|---|---|---|
| 233827 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 180 |
| 235767 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 200 |
| 237077 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 215 |
| 238087 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 515 |
| 239701 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 315 |
| 239701 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 315 |
| 46052F-R | ALL UNNAMED AQUIFERS | Commercial | <Null> | 100 |
| 258919 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 225 |
| 260350 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 480 |
| 43342-A | ALL UNNAMED AQUIFERS | Domestic | <Null> | 240 |
| 270239 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | 280 |
| 275470 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | 460 |
| 275470 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | 460 |
| 276232 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | 580 |
| 215983-A | ALL UNNAMED AQUIFERS | Domestic | <Null> | 290 |
| 287455 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 320 |
| 290267 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | 400 |
| 292021 | ALL UNNAMED AQUIFERS | Household use only | <Null> | <Null> |
| 78822F | ALL UNNAMED AQUIFERS | Other | <Null> | <Null> |
| 300506 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 775 |
| 301600 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 500 |
| 301597 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 100 |
| 301601 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 600 |
| 301598 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 100 |
| 301603 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 200 |
| 301598 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 100 |
| 301600-A | ALL UNNAMED AQUIFERS | Domestic | <Null> | 100 |
| 301600-A | ALL UNNAMED AQUIFERS | Domestic | <Null> | 100 |
| 144365 | ALL UNNAMED AQUIFERS | Domestic | <Null> | <Null> |
| 44904 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 22 |
| 21556 | ALL UNNAMED AQUIFERS | Domestic | <Null> | <Null> |
| 10350 | ALL UNNAMED AQUIFERS | Domestic | <Null> | <Null> |
| 44202 | ALL UNNAMED AQUIFERS | Domestic | <Null> | <Null> |
| 8568 | ALL UNNAMED AQUIFERS | Stock | <Null> | <Null> |
| 47740 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 320 |
| 39396 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 220 |
| 43341 | ALL UNNAMED AQUIFERS | Domestic | <Null> | <Null> |
| 43342 | ALL UNNAMED AQUIFERS | Domestic | <Null> | <Null> |
| 55817 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | 173 |
| 108315 | ALL UNNAMED AQUIFERS | Domestic | <Null> | <Null> |
| 60502 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | 80 |
| 68659 | ALL UNNAMED AQUIFERS | Household use only | <Null> | 50 |
| 304787 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 175 |
| 46052F-R | DAKOTA | Commercial | <Null> | 250 |
| 305825 | ALL UNNAMED AQUIFERS | Domestic, Irrigation | <Null> | 100 |
| 269359 | ALL UNNAMED AQUIFERS | Household use only | <Null> | 320 |

| Permit | Associated Aquifers | Associated Uses | Elevation | Well Depth |
|---|---|---|---|---|
| 301599 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 100 |
| 198720 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 280 |
| 198720 | ALL UNNAMED AQUIFERS | Domestic | <Null> | 280 |
| 269113 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | 360 |
| 312799 | ALL UNNAMED AQUIFERS | Domestic, Stock | <Null> | 100 |

| Permit | Top Perforated Casing | Bottom Perforated Casing | Yield | Static Water Level |
|---|---|---|---|---|
| 25221MH | 60 | 380 | <Null> | 65 |
| 30210MH | 40 | 380 | <Null> | 50 |
| 78124 | 38 | 200 | <Null> | 42 |
| 88822 | <Null> | <Null> | <Null> | <Null> |
| 140871-A | <Null> | <Null> | <Null> | <Null> |
| 145102 | 40 | 350 | <Null> | 50 |
| 153943 | <Null> | <Null> | <Null> | <Null> |
| 43341-A | 40 | 80 | 10 | 37 |
| 153943 | <Null> | <Null> | <Null> | <Null> |
| 155081 | <Null> | <Null> | <Null> | <Null> |
| 155081-A | 204 | 264 | 2 | 235 |
| 155379 | 20 | 158 | <Null> | 25 |
| 47740-A | 200 | 320 | <Null> | 60 |
| 159430 | 80 | 360 | 1 | 85 |
| 162121 | <Null> | <Null> | <Null> | 100 |
| 168370 | 255 | 295 | 2 | 120 |
| 174707 | <Null> | <Null> | 1 | 41 |
| 177783 | 60 | 175 | <Null> | 30 |
| 192134 | 115 | 175 | 13 | 90 |
| 46051F | 60 | 380 | 2.25 | 60 |
| 194842 | 335 | 395 | 5 | 136 |
| 194843 | 415 | 475 | 2 | 64 |
| 194841 | 405 | 455 | <Null> | 70 |
| 194841 | 405 | 455 | <Null> | 70 |
| 195974 | 335 | 395 | 10 | 6 |
| 198721 | 220 | 280 | <Null> | 55 |
| 198714 | <Null> | <Null> | <Null> | <Null> |
| 198722 | <Null> | <Null> | 5 | 105 |
| 198715 | 450 | 550 | 1.5 | 362 |
| 198155 | 105 | 125 | 8 | 25 |
| 198713 | 215 | 275 | <Null> | 50 |
| 202223 | <Null> | <Null> | 7 | 80 |
| 203262 | 40 | 380 | 1 | 50 |
| 207552 | 254 | 355 | <Null> | 5 |
| 208605 | <Null> | <Null> | <Null> | <Null> |
| 213831 | 470 | 530 | 4 | 200 |
| 213835 | <Null> | <Null> | <Null> | <Null> |
| 213832 | 200 | 300 | <Null> | 60 |
| 215223 | 410 | 550 | 7 | 135 |
| 198714-A | 290 | 350 | 6 | 50 |
| 215395 | 500 | 600 | 12 | 190 |
| 215222 | 560 | 700 | 1.5 | 225 |
| 215394 | 270 | 330 | 1.75 | 38 |
| 215218 | 575 | 675 | 1.25 | 178 |
| 217453 | 160 | 335 | <Null> | 130 |
| 221113 | 21 | 32 | <Null> | 15 |

| Permit | Top Perforated Casing | Bottom Perforated Casing | Yield | Static Water Level |
|---|---|---|---|---|
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| 235767 | 120 | 200 | <Null> | 10 |
| 237077 | 175 | 215 | <Null> | 102 |
| 238087 | 315 | 515 | <Null> | <Null> |
| 239701 | 255 | 315 | <Null> | 128 |
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| 46052F-R | 60 | 80 | 12 | 7 |
| 258919 | 185 | 225 | <Null> | 1 |
| 260350 | 400 | 480 | 7 | 30 |
| 43342-A | 160 | 240 | <Null> | 90 |
| 270239 | 200 | 280 | 10 | 43 |
| 275470 | 380 | 460 | 7.5 | 0 |
| 275470 | 380 | 460 | 7.5 | 0 |
| 276232 | 500 | 580 | 8 | 100 |
| 215983-A | 210 | 290 | 12 | 40 |
| 287455 | 260 | 320 | <Null> | 10 |
| 290267 | 320 | 400 | <Null> | 45 |
| 292021 | <Null> | <Null> | <Null> | <Null> |
| 78822F | <Null> | 35 | <Null> | 30 |
| 300506 | <Null> | <Null> | <Null> | <Null> |
| 301600 | 300 | 500 | <Null> | 10 |
| 301597 | 40 | 100 | <Null> | 10 |
| 301601 | 60 | 580 | <Null> | 46 |
| 301598 | 21 | 100 | <Null> | 14 |
| 301603 | 40 | 200 | <Null> | <Null> |
| 301598 | 21 | 100 | <Null> | 14 |
| 301600-A | 21 | 100 | <Null> | 11 |
| 301600-A | 21 | 100 | <Null> | 11 |
| 144365 | <Null> | <Null> | <Null> | <Null> |
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| 8568 | <Null> | <Null> | <Null> | <Null> |
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| 39396 | 180 | 220 | <Null> | 35 |
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| 108315 | <Null> | <Null> | <Null> | <Null> |
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| 68659 | 10 | 50 | <Null> | 10 |
| 304787 | <Null> | <Null> | <Null> | 50 |
| 46052F-R | <Null> | <Null> | <Null> | 29 |
| 305825 | <Null> | <Null> | <Null> | 16 |
| 269359 | 240 | 320 | 3 | 85 |

| Permit | Top Perforated Casing | Bottom Perforated Casing | Yield | Static Water Level |
|---|---|---|---|---|
| 301599 | 24 | 100 | 15 | 12 |
| 198720 | 220 | 280 | 5 | 100 |
| 198720 | 220 | 280 | 5 | 100 |
| 269113 | 280 | 360 | 3 | 110 |
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| 153943 | <Null> | <Null> | <Null> | 9/7/2018 13:34 |
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| 155081 | <Null> | <Null> | <Null> | 8/9/1989 0:00 |
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| 155379 | <Null> | <Null> | <Null> | 11/22/1989 0:00 |
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| 162121 | <Null> | <Null> | <Null> | 1/13/1992 0:00 |
| 168370 | <Null> | <Null> | <Null> | 8/22/1994 0:00 |
| 174707 | <Null> | <Null> | <Null> | 1/24/1994 0:00 |
| 177783 | <Null> | <Null> | <Null> | 5/2/1994 0:00 |
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| 194843 | <Null> | <Null> | <Null> | 4/25/1997 0:00 |
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| 198714-A | <Null> | <Null> | <Null> | 3/19/1999 0:00 |
| 215395 | <Null> | <Null> | <Null> | 4/12/2002 0:00 |
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| 215394 | <Null> | <Null> | <Null> | 6/12/2000 0:00 |
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| 221113 | <Null> | <Null> | <Null> | 8/7/2018 16:31 |

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| 235767 | <Null> | <Null> | <Null> | 2/7/2002 0:00 |
| 237077 | <Null> | <Null> | <Null> | 12/3/2001 0:00 |
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| 301600 | <Null> | <Null> | <Null> | 4/4/2017 0:00 |
| 301597 | <Null> | <Null> | <Null> | 10/25/2016 0:00 |
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| 30210MH | https://dwr.state.co.us/Tools/WellPermits/0030210 | (38.497277, -105.353818) |
| 78124 | https://dwr.state.co.us/Tools/WellPermits/0057935 | (38.488659, -105.346841) |
| 88822 | https://dwr.state.co.us/Tools/WellPermits/0078591A | (38.505911, -105.351913) |
| 140871-A | https://dwr.state.co.us/Tools/WellPermits/0256699B | (38.504148, -105.351113) |
| 145102 | https://dwr.state.co.us/Tools/WellPermits/0263499 | (38.495698, -105.348365) |
| 153943 | https://dwr.state.co.us/Tools/WellPermits/0298963 | (38.507416, -105.356774) |
| 43341-A | https://dwr.state.co.us/Tools/WellPermits/0298903 | (38.491301, -105.378794) |
| 153943 | https://dwr.state.co.us/Tools/WellPermits/0298963 | (38.507416, -105.356774) |
| 155081 | https://dwr.state.co.us/Tools/WellPermits/0300895A | (38.497983, -105.345387) |
| 155081-A | https://dwr.state.co.us/Tools/WellPermits/0300895B | (38.497237, -105.34477) |
| 155379 | https://dwr.state.co.us/Tools/WellPermits/0304008 | (38.478638, -105.353135) |
| 47740-A | https://dwr.state.co.us/Tools/WellPermits/0312268 | (38.490526, -105.378809) |
| 159430 | https://dwr.state.co.us/Tools/WellPermits/0321527 | (38.491012, -105.345214) |
| 162121 | https://dwr.state.co.us/Tools/WellPermits/0330646B | (38.488485, -105.35996) |
| 168370 | https://dwr.state.co.us/Tools/WellPermits/0348451 | (38.475568, -105.347633) |
| 174707 | https://dwr.state.co.us/Tools/WellPermits/0361132 | (38.483462, -105.34917) |
| 177783 | https://dwr.state.co.us/Tools/WellPermits/0366520 | (38.498862, -105.348078) |
| 192134 | https://dwr.state.co.us/Tools/WellPermits/0393018 | (38.52063, -105.360529) |
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| 194842 | https://dwr.state.co.us/Tools/WellPermits/0396600 | (38.514136, -105.365075) |
| 194843 | https://dwr.state.co.us/Tools/WellPermits/0396601 | (38.516912, -105.36489) |
| 194841 | https://dwr.state.co.us/Tools/WellPermits/0397345 | (38.519481, -105.378786) |
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| 195974 | https://dwr.state.co.us/Tools/WellPermits/0400151 | (38.520291, -105.360861) |
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| 215395 | https://dwr.state.co.us/Tools/WellPermits/0440016E | (38.52066, -105.383657) |
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| 237077 | https://dwr.state.co.us/Tools/WellPermits/0482349 | (38.503894, -105.356315) |
| 238087 | https://dwr.state.co.us/Tools/WellPermits/0484828 | (38.501481, -105.362913) |
| 239701 | https://dwr.state.co.us/Tools/WellPermits/0488962 | (38.505466, -105.359299) |
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| 46052F-R | https://dwr.state.co.us/Tools/WellPermits/0512665 | (38.502382, -105.348024) |
| 258919 | https://dwr.state.co.us/Tools/WellPermits/0526341 | (38.505153, -105.355137) |
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| 276232 | https://dwr.state.co.us/Tools/WellPermits/3623960 | (38.50163, -105.36272) |
| 215983-A | https://dwr.state.co.us/Tools/WellPermits/3642638 | (38.494645, -105.366873) |
| 287455 | https://dwr.state.co.us/Tools/WellPermits/3653791 | (38.499813, -105.353972) |
| 290267 | https://dwr.state.co.us/Tools/WellPermits/3658346A | (38.492291, -105.354203) |
| 292021 | https://dwr.state.co.us/Tools/WellPermits/3659855 | (38.505246, -105.35103) |
| 78822F | https://dwr.state.co.us/Tools/WellPermits/3667100 | (38.489983, -105.395061) |
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| 301600-A | https://dwr.state.co.us/Tools/WellPermits/3678038 | (38.523332, -105.39672) |
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| 44202 | https://dwr.state.co.us/Tools/WellPermits/9085951 | (38.500984, -105.349843) |
| 8568 | https://dwr.state.co.us/Tools/WellPermits/9085600 | (38.532422, -105.417574) |
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| 60502 | https://dwr.state.co.us/Tools/WellPermits/9086131 | (38.493704, -105.349298) |
| 68659 | https://dwr.state.co.us/Tools/WellPermits/9086241 | (38.503651, -105.349916) |
| 304787 | https://dwr.state.co.us/Tools/WellPermits/3678593 | (38.515068, -105.356732) |
| 46052F-R | https://dwr.state.co.us/Tools/WellPermits/3680613 | (38.502387, -105.348034) |
| 305825 | https://dwr.state.co.us/Tools/WellPermits/3680224 | (38.522989, -105.396039) |
| 269359 | https://dwr.state.co.us/Tools/WellPermits/3604319 | (38.526376, -105.380203) |

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| 198720 | https://dwr.state.co.us/Tools/WellPermits/0405665I | (38.514742, -105.377355) |
| 198720 | https://dwr.state.co.us/Tools/WellPermits/0405665I | (38.514742, -105.377355) |
| 269113 | https://dwr.state.co.us/Tools/WellPermits/3604372 | (38.487846, -105.352665) |
| 312799 | https://dwr.state.co.us/Tools/WellPermits/3690612 | (38.521287, -105.398405) |

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| 30210MH | 0030210 90865 | Point | Colorado DWR | 10/22/2019 | 10/22/2019 |
| 78124 | 0057935 221010 | Point | Colorado DWR | 10/22/2019 | 10/22/2019 |
| 88822 | 0078591A 139530 | Point | Colorado DWR | 10/22/2019 | 10/22/2019 |
| 140871-A | 0256699B 94229 | Point | Colorado DWR | 10/22/2019 | 10/22/2019 |
| 145102 | 0263499 17709 | Point | Colorado DWR | 10/22/2019 | 10/22/2019 |
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| 43341 | https://data.colorado.gov/Water/DWR-Well-Application-Permit/wumm-7awb |
| 43342 | https://data.colorado.gov/Water/DWR-Well-Application-Permit/wumm-7awb |
| 55817 | https://data.colorado.gov/Water/DWR-Well-Application-Permit/wumm-7awb |
| 108315 | https://data.colorado.gov/Water/DWR-Well-Application-Permit/wumm-7awb |
| 60502 | https://data.colorado.gov/Water/DWR-Well-Application-Permit/wumm-7awb |
| 68659 | https://data.colorado.gov/Water/DWR-Well-Application-Permit/wumm-7awb |
| 304787 | https://data.colorado.gov/Water/DWR-Well-Application-Permit/wumm-7awb |
| 46052F-R | https://data.colorado.gov/Water/DWR-Well-Application-Permit/wumm-7awb |
| 305825 | https://data.colorado.gov/Water/DWR-Well-Application-Permit/wumm-7awb |
| 269359 | https://data.colorado.gov/Water/DWR-Well-Application-Permit/wumm-7awb |

| **Permit** | **Website** |
|---|---|
| 301599 | https://data.colorado.gov/Water/DWR-Well-Application-Permit/wumm-7awb |
| 198720 | https://data.colorado.gov/Water/DWR-Well-Application-Permit/wumm-7awb |
| 198720 | https://data.colorado.gov/Water/DWR-Well-Application-Permit/wumm-7awb |
| 269113 | https://data.colorado.gov/Water/DWR-Well-Application-Permit/wumm-7awb |
| 312799 | https://data.colorado.gov/Water/DWR-Well-Application-Permit/wumm-7awb |

| Permit | Proximity | SurfElev. (ft) | WLE (ft) |
|---|---|---|---|
| 25221MH | Water Resources Study Area | 6,225 | 6,160 |
| 30210MH | Water Resources Study Area | 6,288 | 6,238 |
| 78124 | Water Resources Study Area | 6,170 | 6,128 |
| 88822 | Water Resources Study Area | 6,162 | |
| 140871-A | Water Resources Study Area | 6,164 | |
| 145102 | Water Resources Study Area | 6,220 | 6,170 |
| 153943 | Water Resources Study Area | 6,168 | |
| 43341-A | Water Resources Study Area | 5,829 | 5,792 |
| 153943 | Water Resources Study Area | 6,168 | |
| 155081 | Water Resources Study Area | 6,256 | |
| 155081-A | Water Resources Study Area | 6,251 | 6,016 |
| 155379 | Water Resources Study Area | 5,968 | 5,943 |
| 47740-A | Water Resources Study Area | 5,798 | 5,738 |
| 159430 | Water Resources Study Area | 6,204 | 6,119 |
| 162121 | Water Resources Study Area | 6,257 | 6,157 |
| 168370 | Water Resources Study Area | 6,115 | 5,995 |
| 174707 | Water Resources Study Area | 6,197 | 6,156 |
| 177783 | Water Resources Study Area | 6,250 | 6,220 |
| 192134 | Water Resources Study Area | 6,450 | 6,360 |
| 46051F | Water Resources Study Area | 6,245 | 6,185 |
| 194842 | Water Resources Study Area | 6,382 | 6,246 |
| 194843 | Water Resources Study Area | 6,368 | 6,304 |
| 194841 | Water Resources Study Area | 6,393 | 6,323 |
| 194841 | Water Resources Study Area | 6,393 | 6,323 |
| 195974 | Water Resources Study Area | 6,445 | 6,439 |
| 198721 | Water Resources Study Area | 6,658 | 6,603 |
| 198714 | Water Resources Study Area | 6,218 | |
| 198722 | Water Resources Study Area | 6,599 | 6,494 |
| 198715 | Water Resources Study Area | 6,209 | 5,847 |
| 198155 | Water Resources Study Area | 6,303 | 6,278 |
| 198713 | Water Resources Study Area | 6,335 | 6,285 |
| 202223 | Water Resources Study Area | 6,367 | 6,287 |
| 203262 | Water Resources Study Area | 6,244 | 6,194 |
| 207552 | Water Resources Study Area | 6,203 | 6,198 |
| 208605 | Water Resources Study Area | 6,090 | |
| 213831 | Water Resources Study Area | 6,163 | 5,963 |
| 213835 | Water Resources Study Area | 6,189 | |
| 213832 | Water Resources Study Area | 6,153 | 6,093 |
| 215223 | Water Resources Study Area | 6,425 | 6,290 |
| 198714-A | Water Resources Study Area | 6,204 | 6,154 |
| 215395 | Water Resources Study Area | 6,379 | 6,189 |
| 215222 | Water Resources Study Area | 7,179 | 6,954 |
| 215394 | Water Resources Study Area | 6,397 | 6,359 |
| 215218 | Water Resources Study Area | 7,219 | 7,041 |
| 217453 | Water Resources Study Area | 6,509 | 6,379 |
| 221113 | Water Resources Study Area | 6,253 | 6,238 |

# DWR Well Records for Water Resources Study Area

| Permit | Proximity | SurfElev. (ft) | WLE (ft) |
|---|---|---|---|
| 233827 | Water Resources Study Area | 6,211 | 6,131 |
| 235767 | Water Resources Study Area | 6,090 | 6,080 |
| 237077 | Water Resources Study Area | 6,154 | 6,052 |
| 238087 | Water Resources Study Area | 6,272 | |
| 239701 | Water Resources Study Area | 6,209 | 6,081 |
| 239701 | Water Resources Study Area | 6,209 | 6,081 |
| 46052F-R | Water Resources Study Area | 6,151 | 6,144 |
| 258919 | Water Resources Study Area | 6,126 | 6,125 |
| 260350 | Water Resources Study Area | 6,334 | 6,304 |
| 43342-A | Water Resources Study Area | 5,747 | 5,657 |
| 270239 | Water Resources Study Area | 6,441 | 6,398 |
| 275470 | Water Resources Study Area | 6,383 | 6,383 |
| 275470 | Water Resources Study Area | 6,383 | 6,383 |
| 276232 | Water Resources Study Area | 6,264 | 6,164 |
| 215983-A | Water Resources Study Area | 5,882 | 5,842 |
| 287455 | Water Resources Study Area | 6,109 | 6,099 |
| 290267 | Water Resources Study Area | 6,225 | 6,180 |
| 292021 | Water Resources Study Area | 6,175 | |
| 78822F | Water Resources Study Area | 5,814 | 5,784 |
| 300506 | Water Resources Study Area | 6,171 | |
| 301600 | Water Resources Study Area | 6,195 | 6,185 |
| 301597 | Water Resources Study Area | 6,116 | 6,106 |
| 301601 | Water Resources Study Area | 6,259 | 6,213 |
| 301598 | Water Resources Study Area | 6,253 | 6,239 |
| 301603 | Water Resources Study Area | 6,174 | |
| 301598 | Water Resources Study Area | 6,253 | 6,239 |
| 301600-A | Water Resources Study Area | 6,122 | 6,111 |
| 301600-A | Water Resources Study Area | 6,122 | 6,111 |
| 144365 | Water Resources Study Area | 6,129 | |
| 44904 | Water Resources Study Area | 6,133 | 6,113 |
| 21556 | Water Resources Study Area | 6,366 | |
| 10350 | Water Resources Study Area | 6,344 | |
| 44202 | Water Resources Study Area | 6,225 | |
| 8568 | Water Resources Study Area | 6,259 | |
| 47740 | Water Resources Study Area | 5,798 | 5,738 |
| 39396 | Water Resources Study Area | 6,174 | 6,139 |
| 43341 | Water Resources Study Area | 5,794 | |
| 43342 | Water Resources Study Area | 5,733 | |
| 55817 | Water Resources Study Area | 6,423 | |
| 108315 | Water Resources Study Area | 6,457 | |
| 60502 | Water Resources Study Area | 6,202 | 6,182 |
| 68659 | Water Resources Study Area | 6,166 | 6,156 |
| 304787 | Water Resources Study Area | 6,375 | 6,325 |
| 46052F-R | Water Resources Study Area | 6,151 | 6,122 |
| 305825 | Water Resources Study Area | 6,127 | 6,111 |
| 269359 | Water Resources Study Area | 6,252 | 6,167 |

| Permit | Proximity | SurfElev. (ft) | WLE (ft) |
|---|---|---|---|
| 301599 | Water Resources Study Area | 6,108 | 6,096 |
| 198720 | Water Resources Study Area | 6,819 | 6,719 |
| 198720 | Water Resources Study Area | 6,819 | 6,719 |
| 269113 | Water Resources Study Area | 6,140 | 6,030 |
| 312799 | Water Resources Study Area | 6,115 | 6,093 |

***Preliminary Draft Environmental Impact Statement***
***Parkdale Quarry Expansion Project***

# *Appendix H*

## Visual Simulations

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Existing Conditions

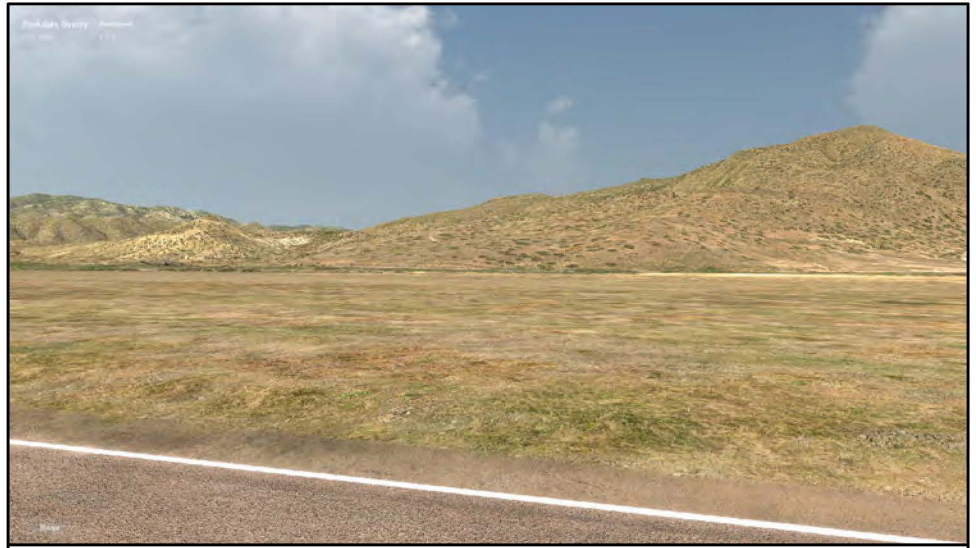
Phase 1

Phase 2

Phase 3

Phase 4

Phase 5



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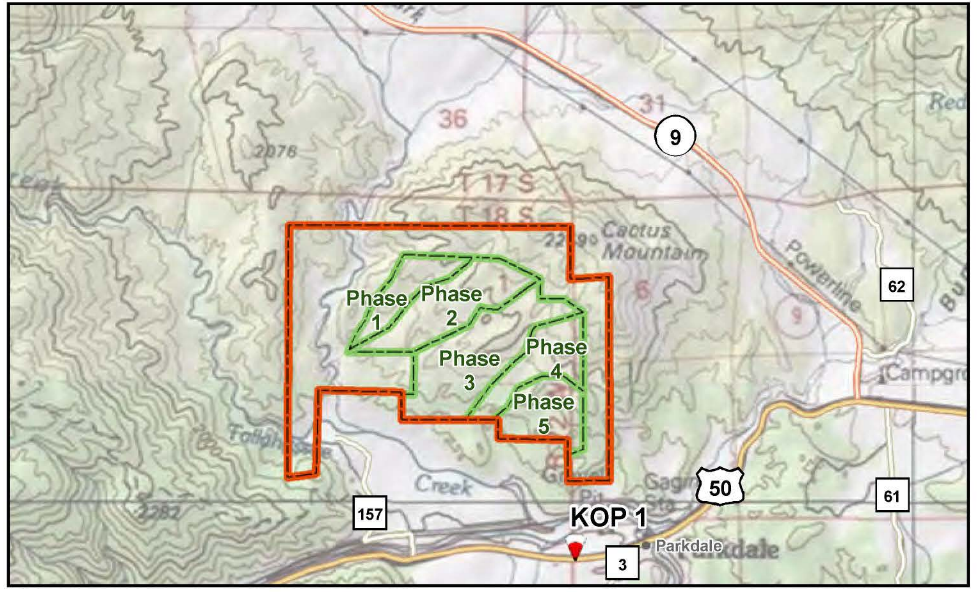

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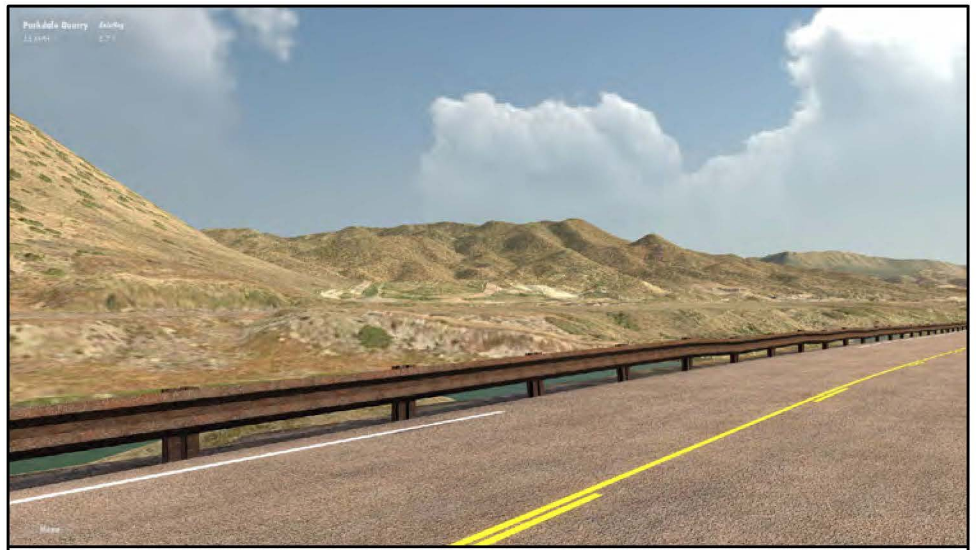
Figure H-1

Alternative A - Visual Simulation from KOP1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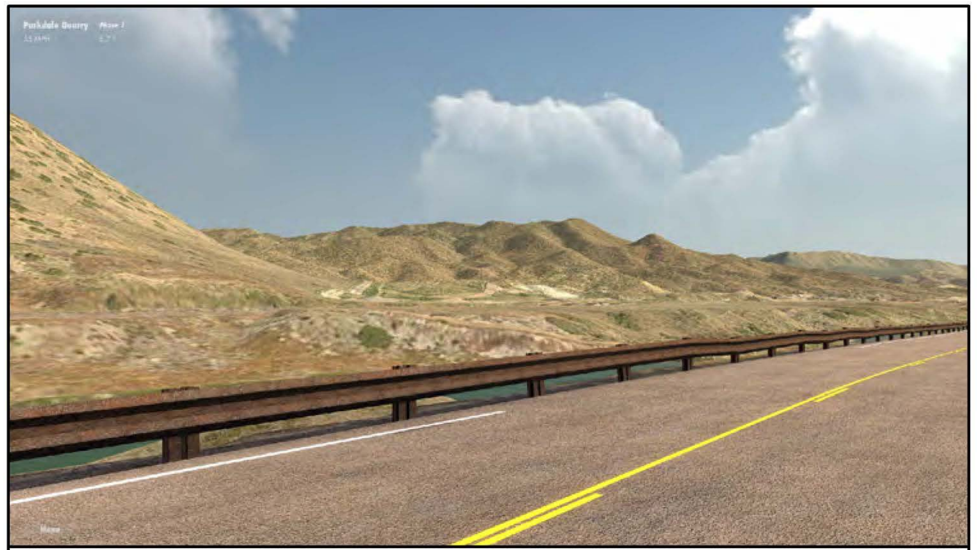
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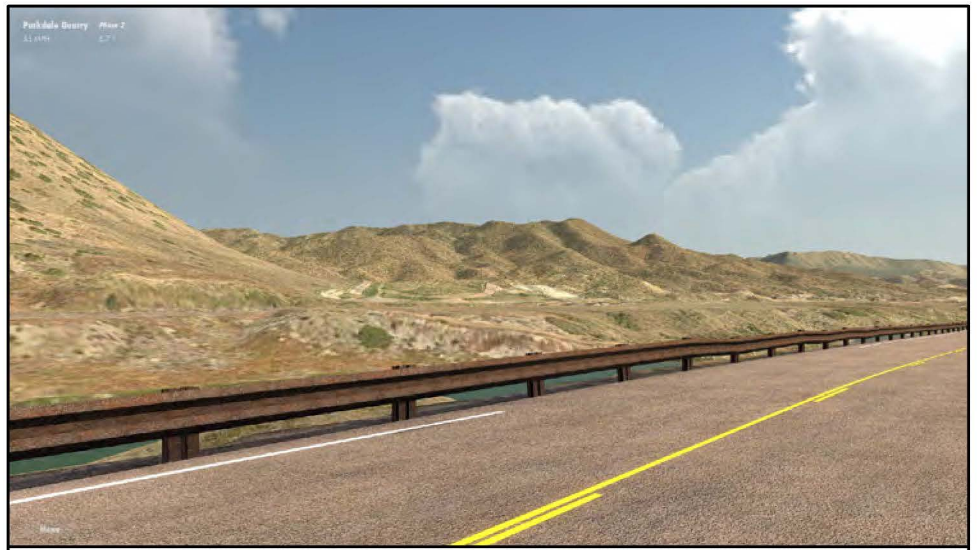
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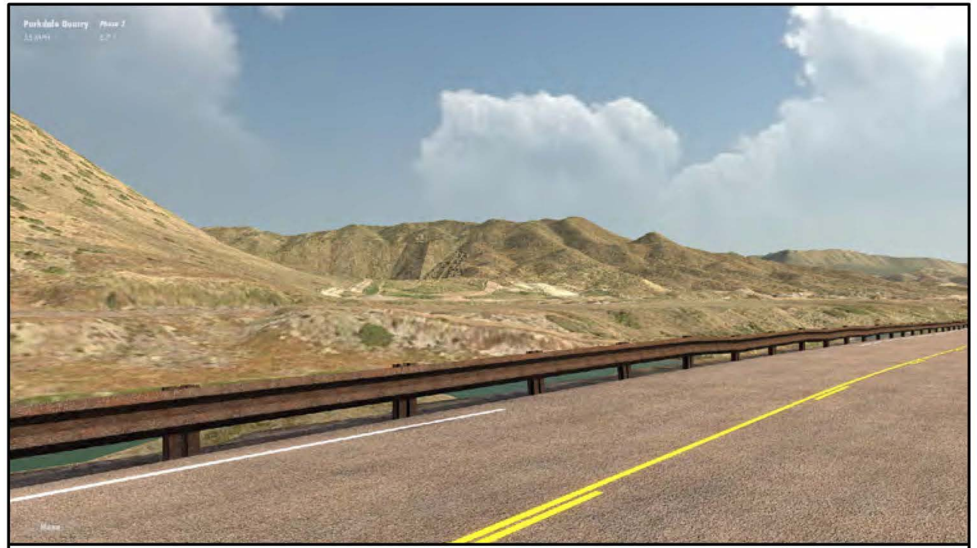
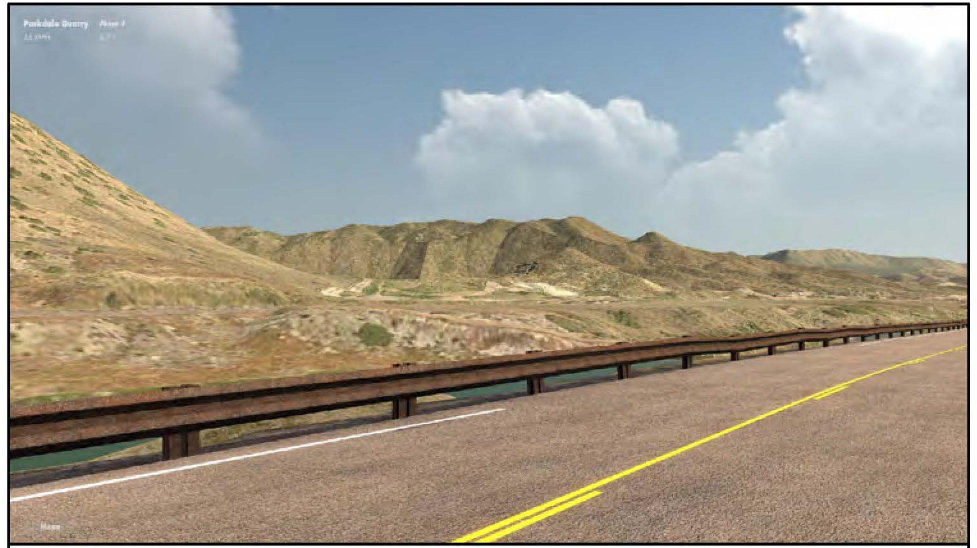
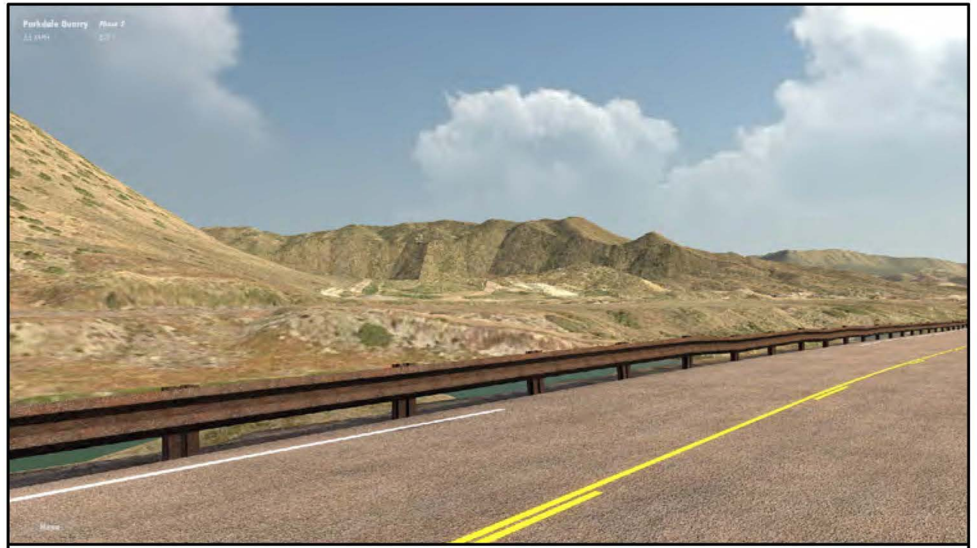
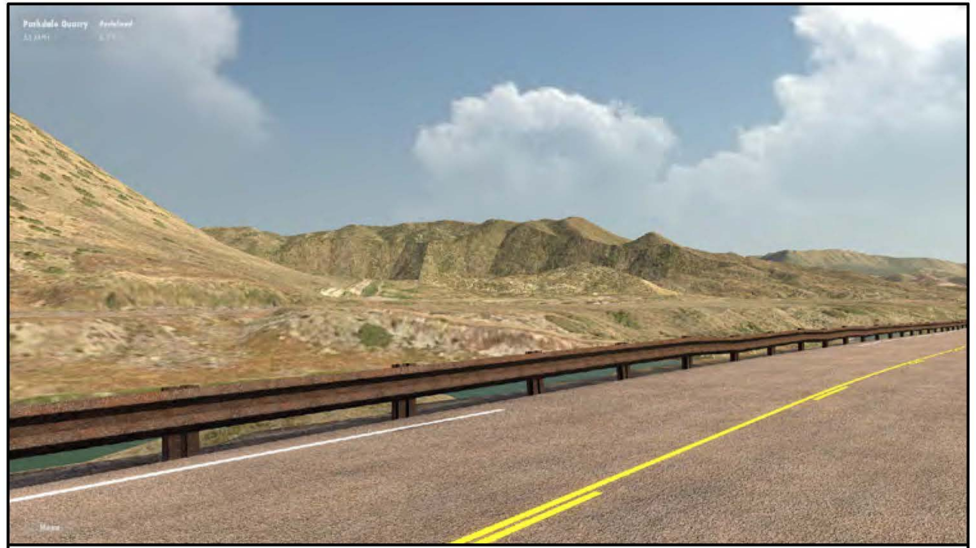

Phase 3


Phase 4


Phase 5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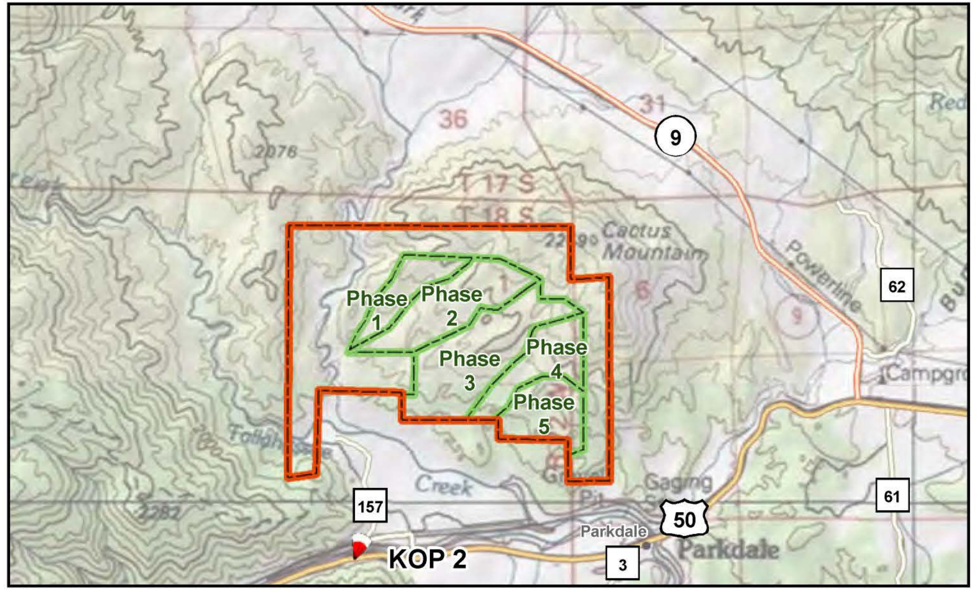

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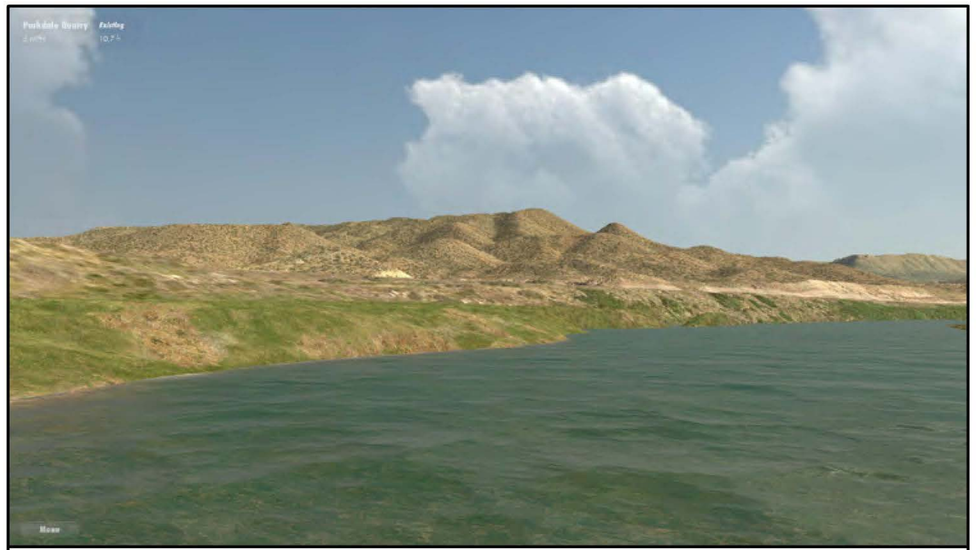
**Figure H-2**
**Alternative A - Visual Simulation from KOP2**



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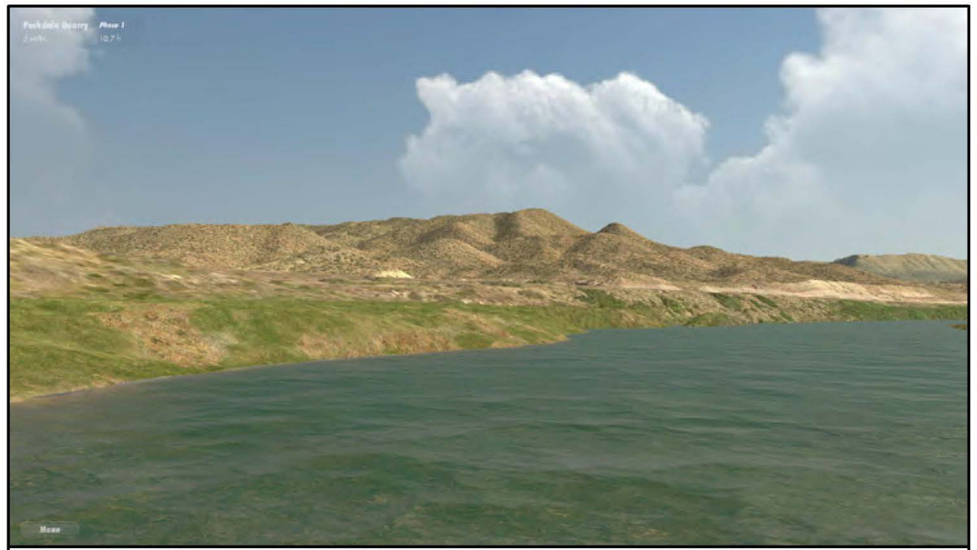
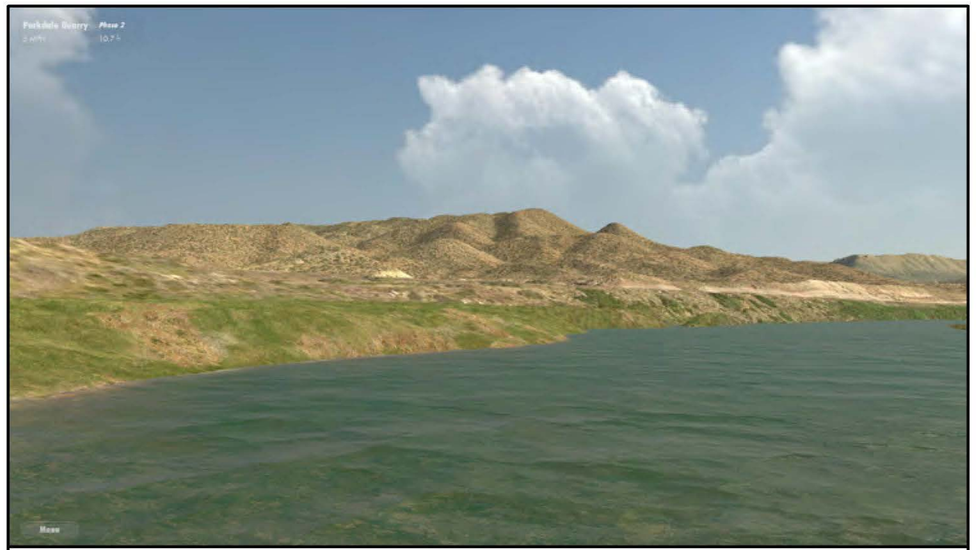
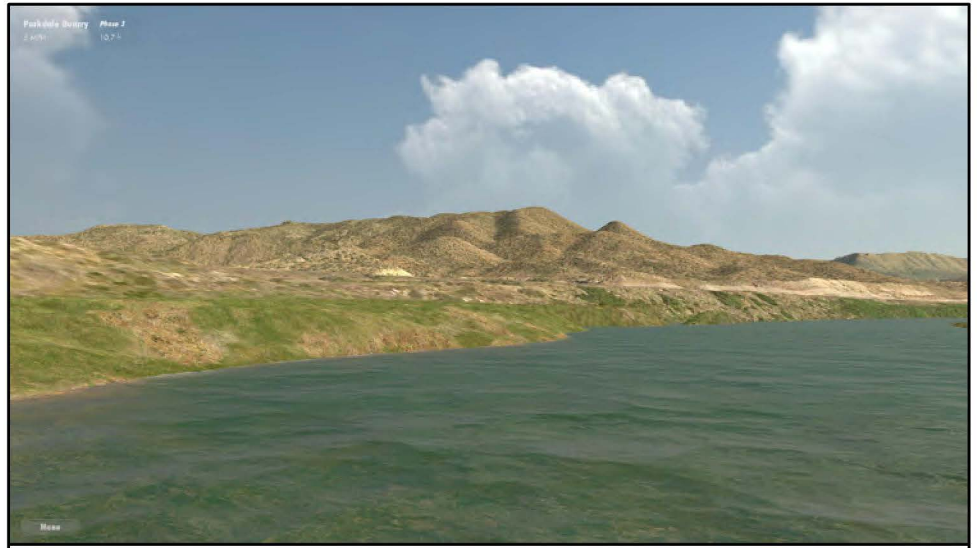


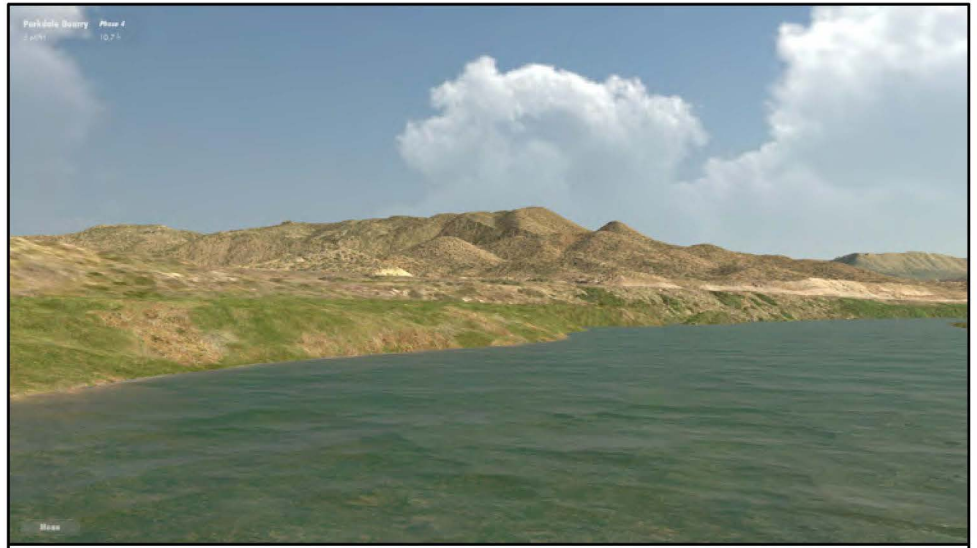
Phase 1



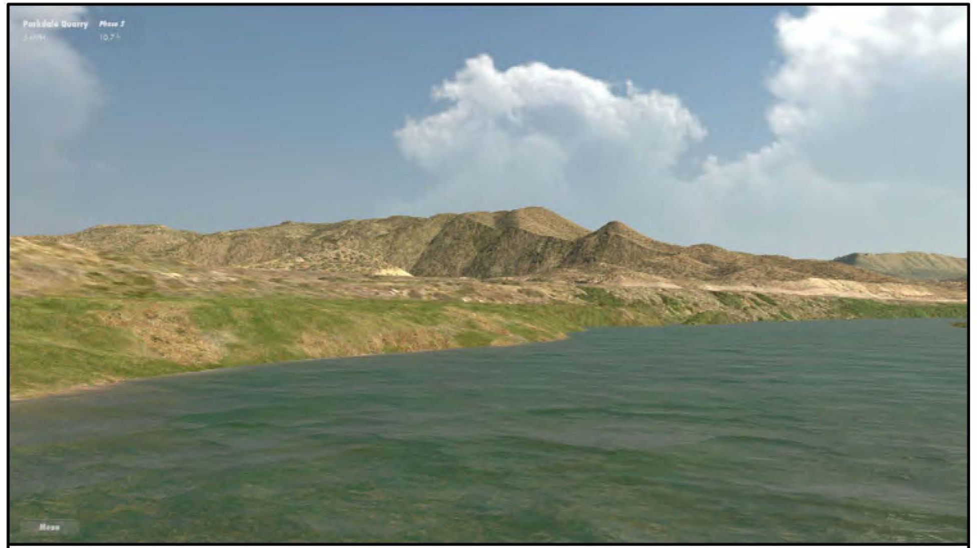
Phase 2



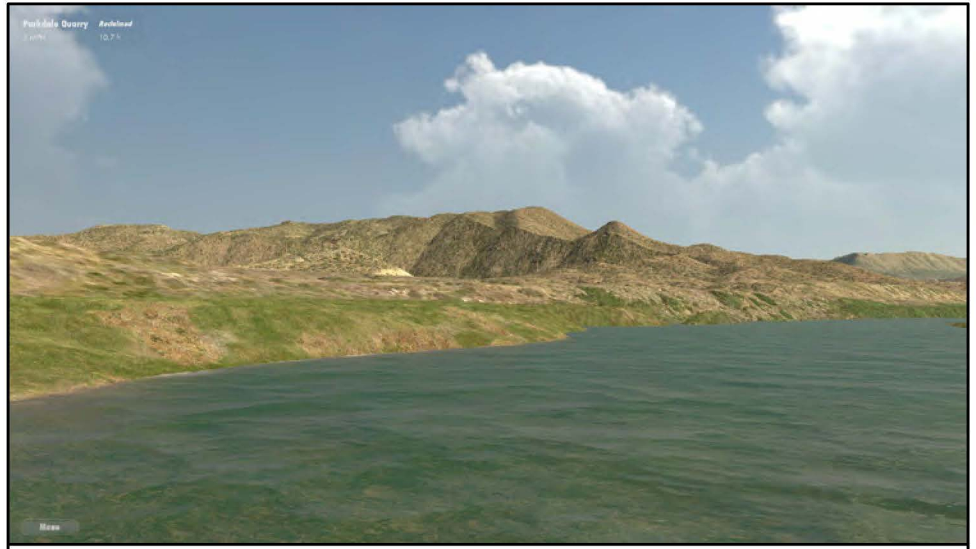
Phase 3



Phase 4



Phase 5



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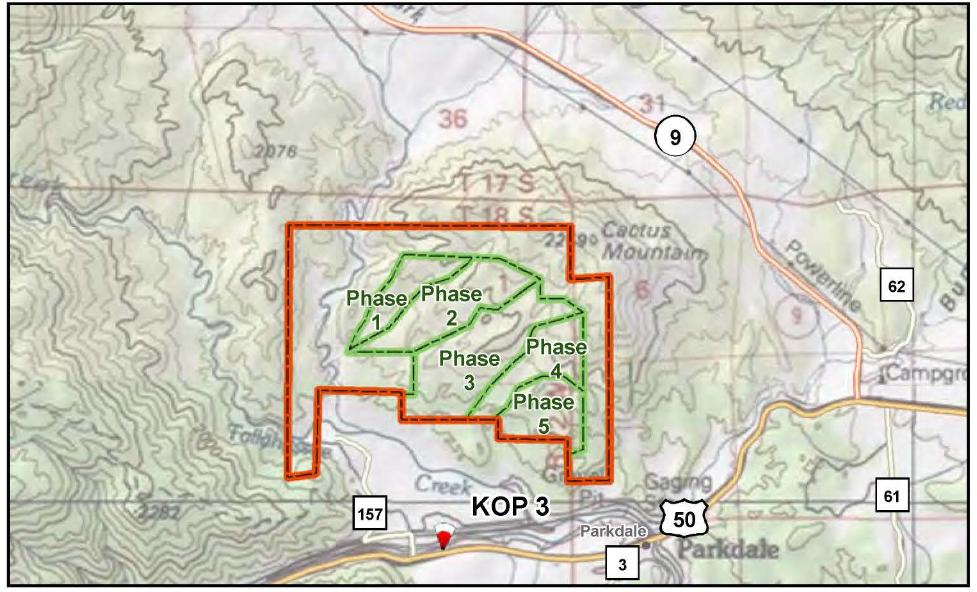

## Figure H-3
## Alternative A - Visual Simulation from KOP3

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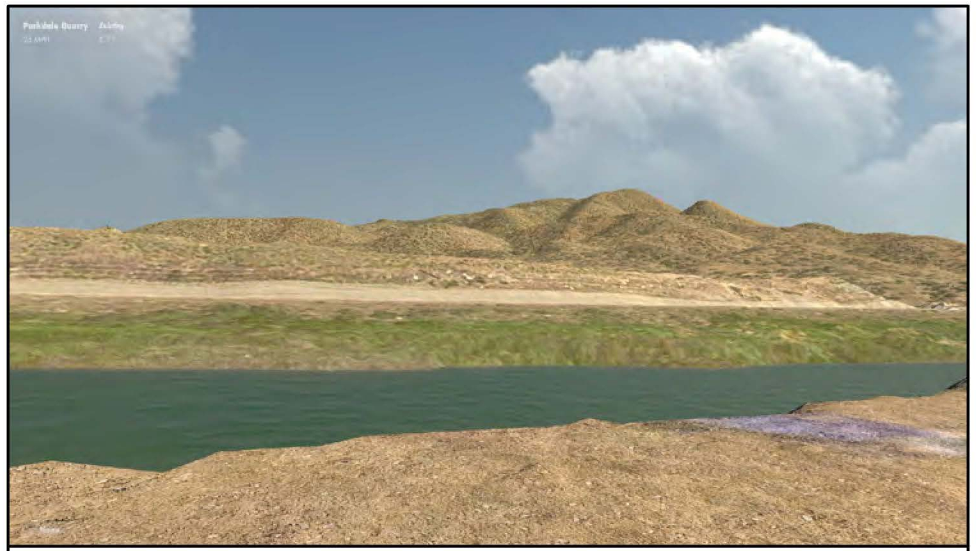

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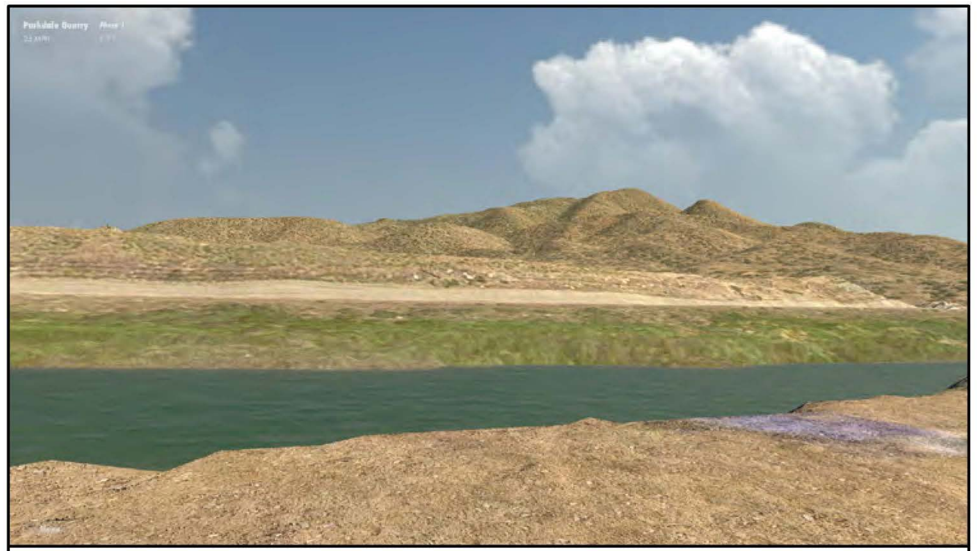

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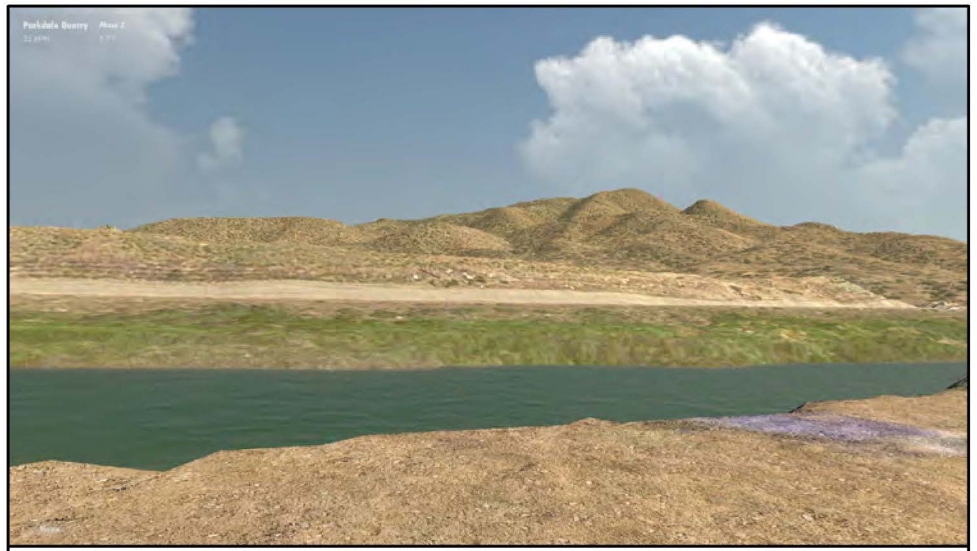
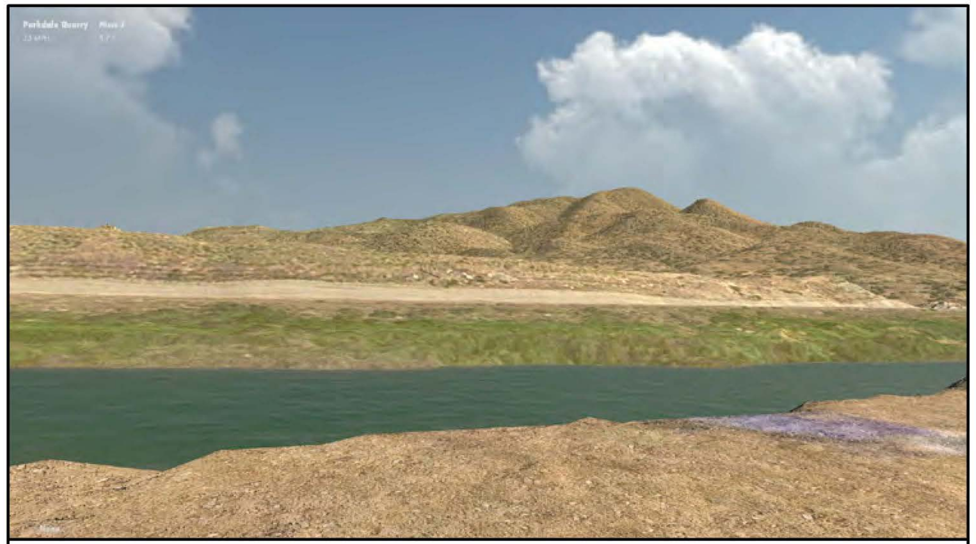
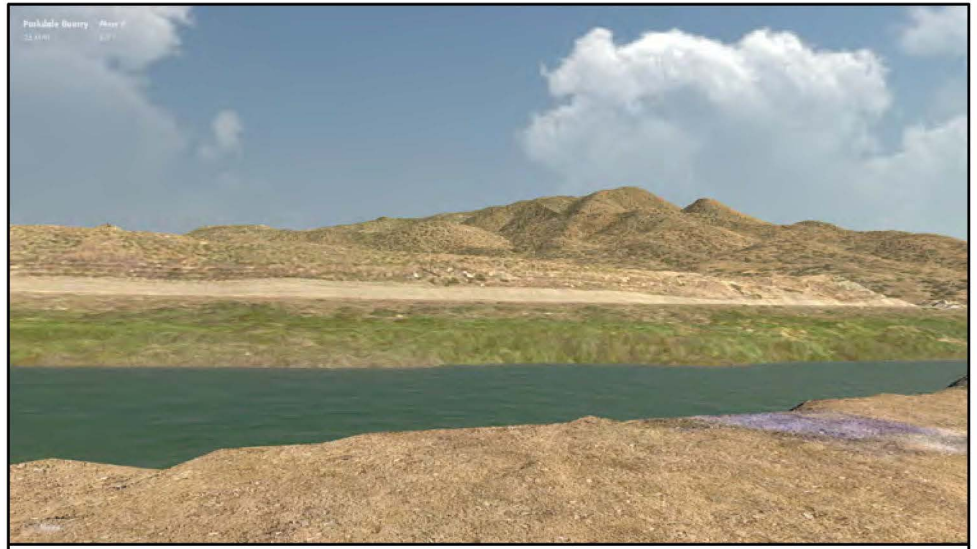


**Phase 2**



**Phase 3**



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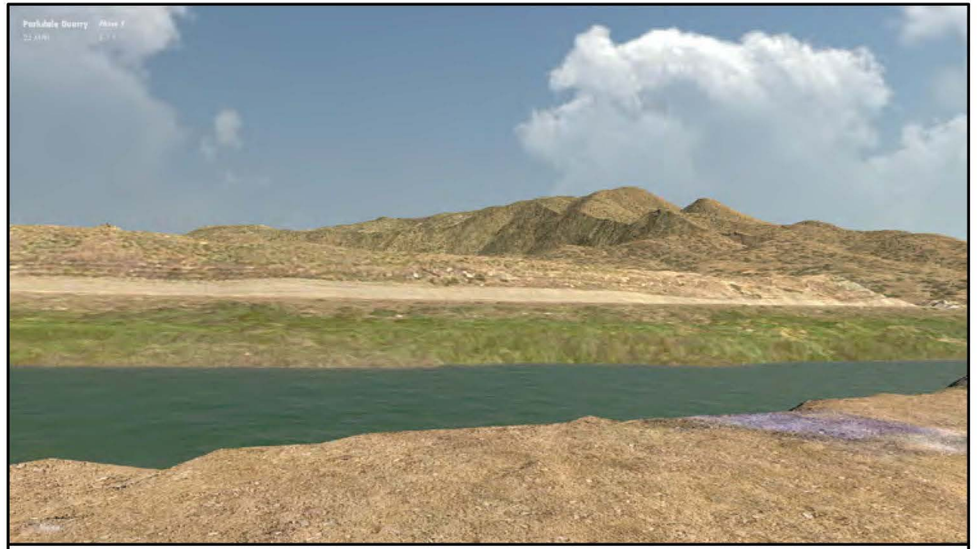

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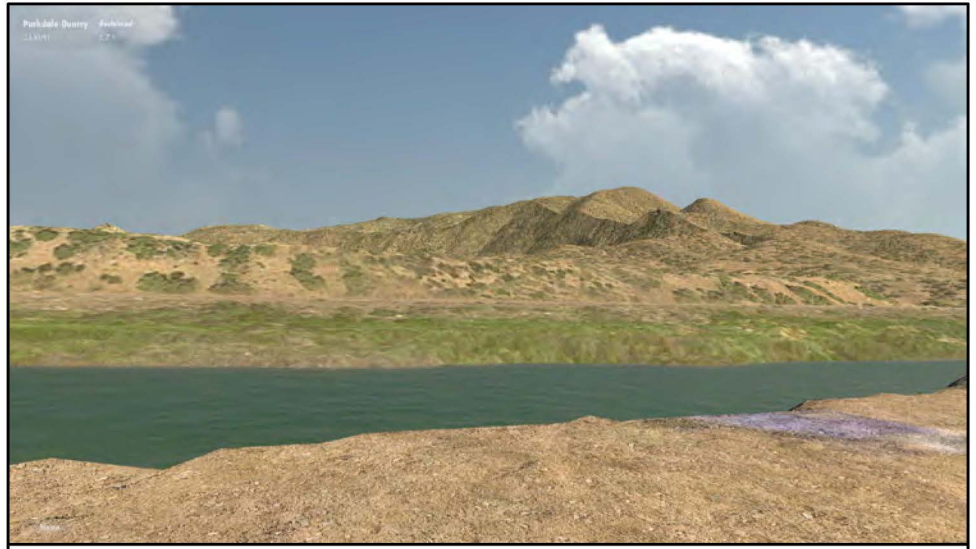

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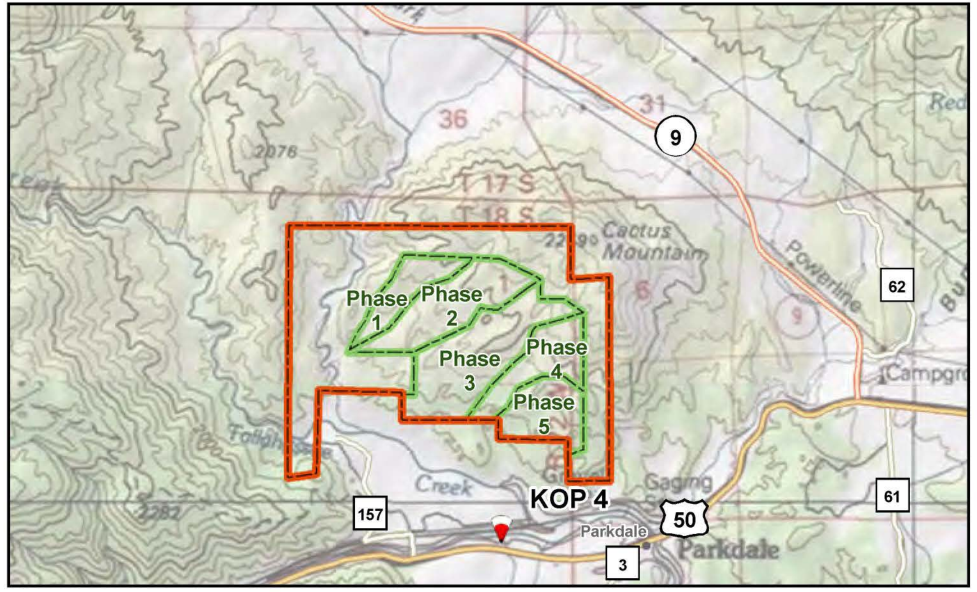

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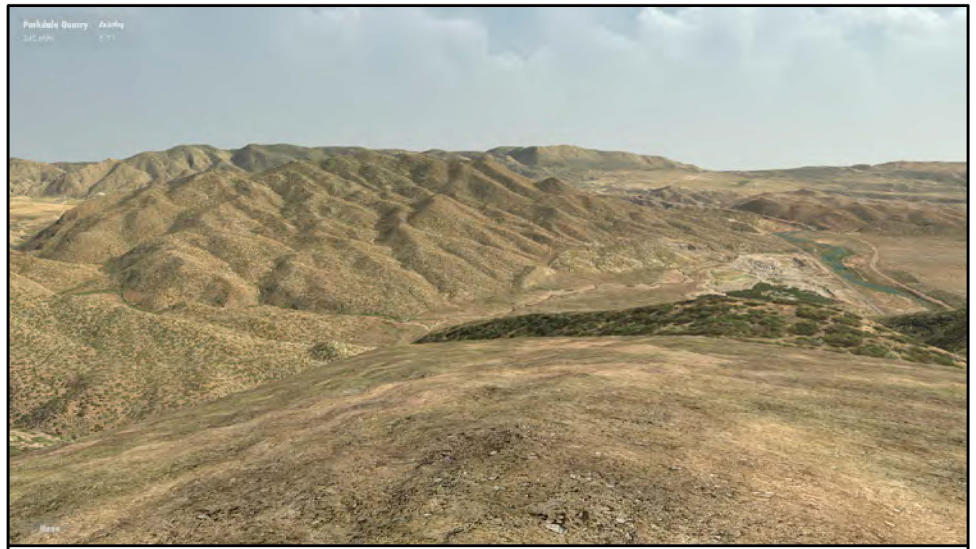
**Figure H-4**
**Alternative A - Visual Simulation from KOP4**



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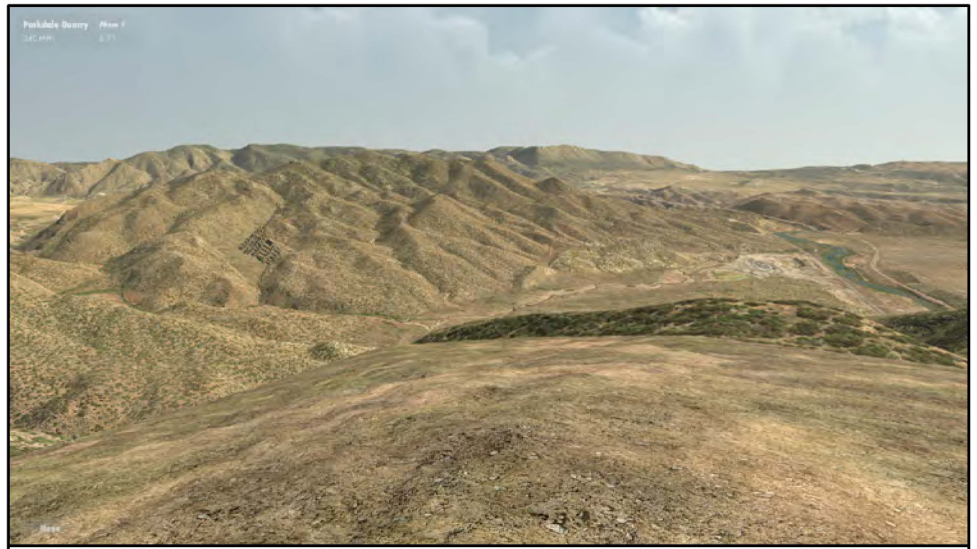
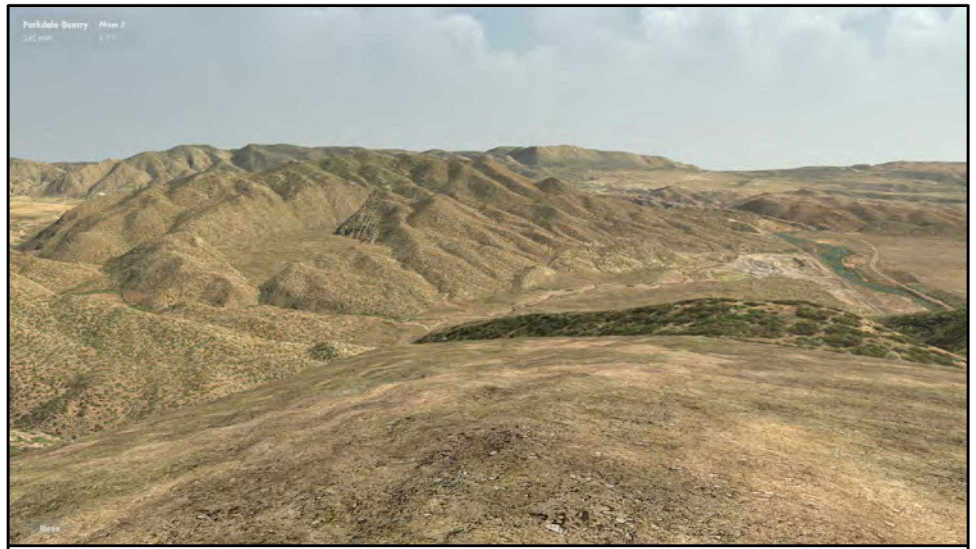


Phase 1



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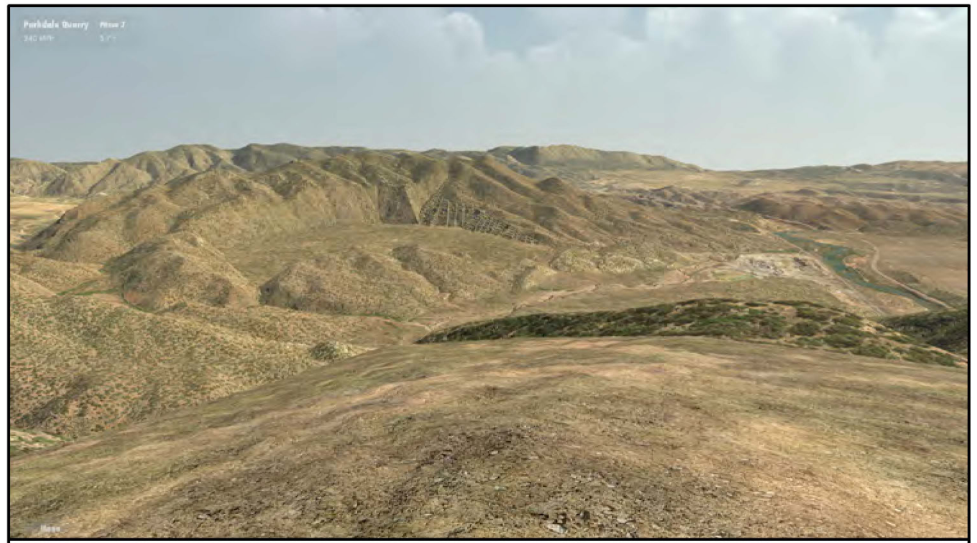

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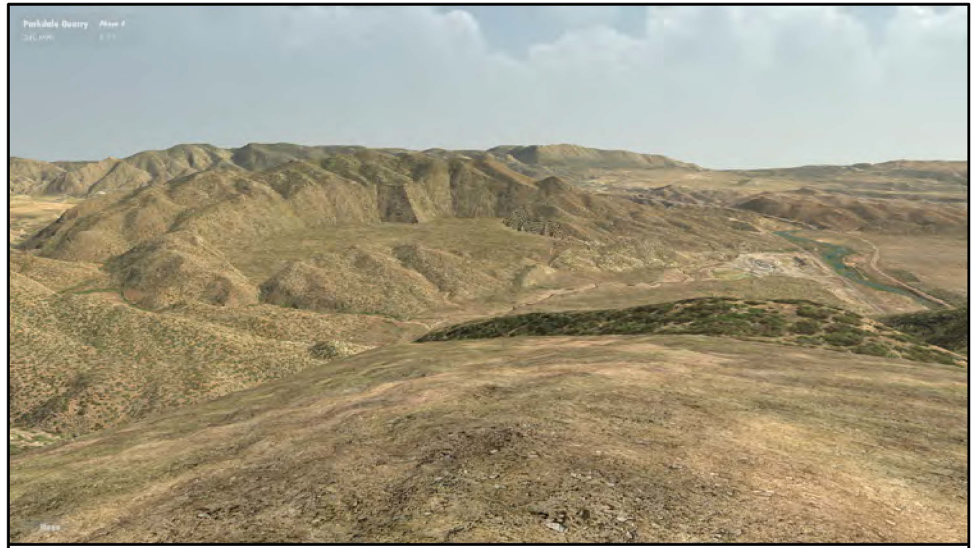

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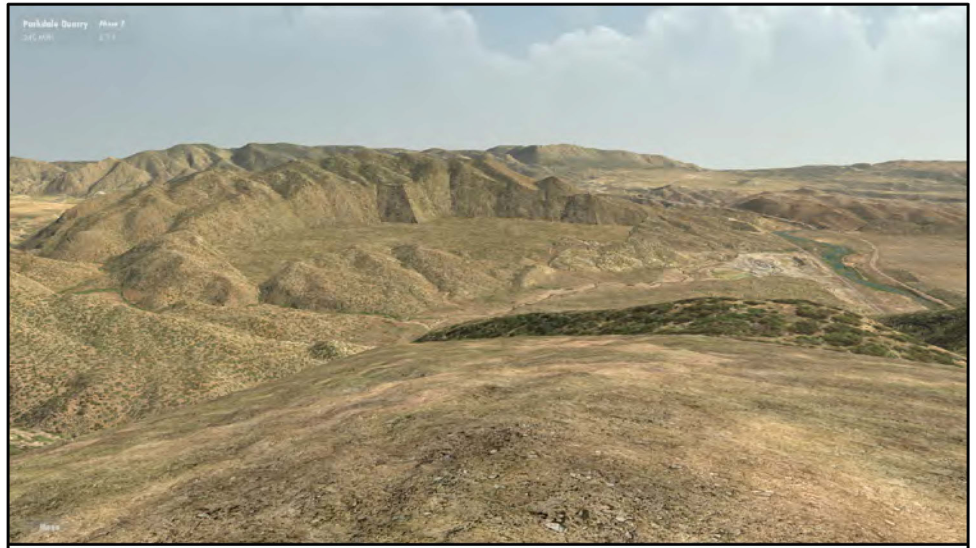

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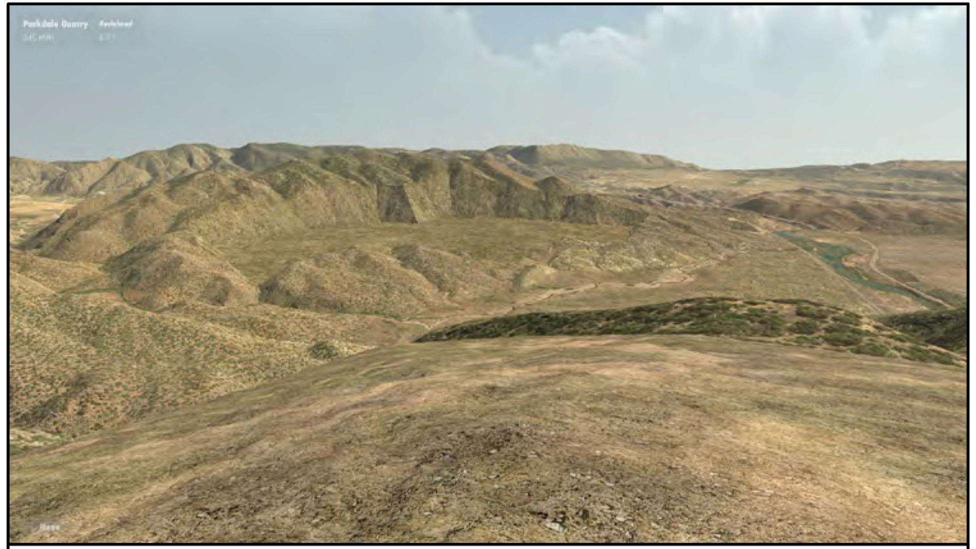

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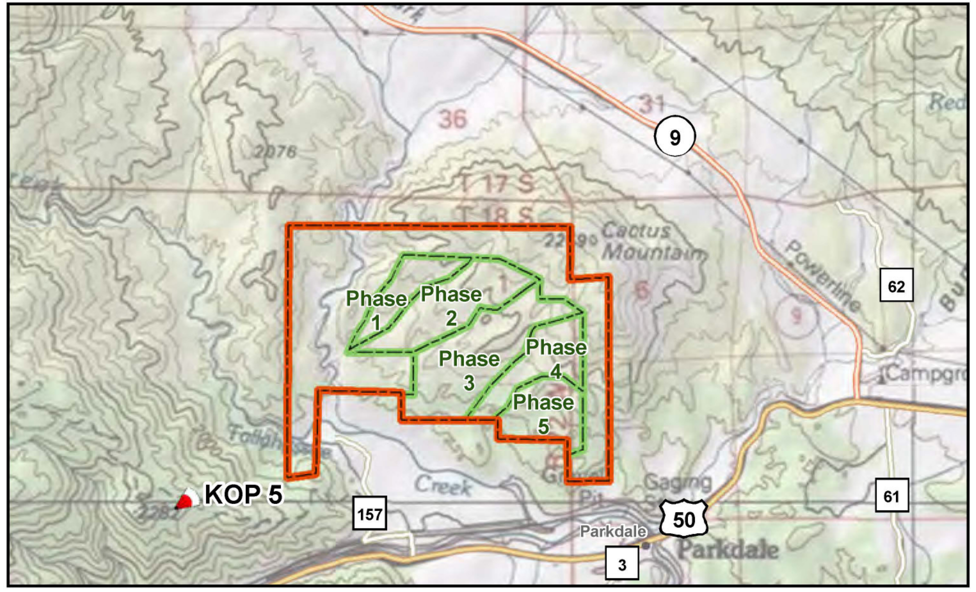

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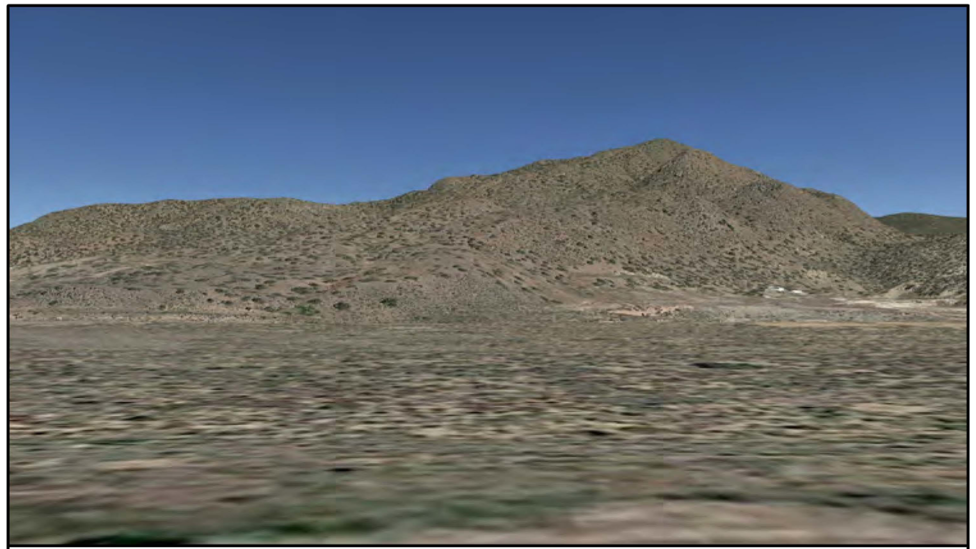
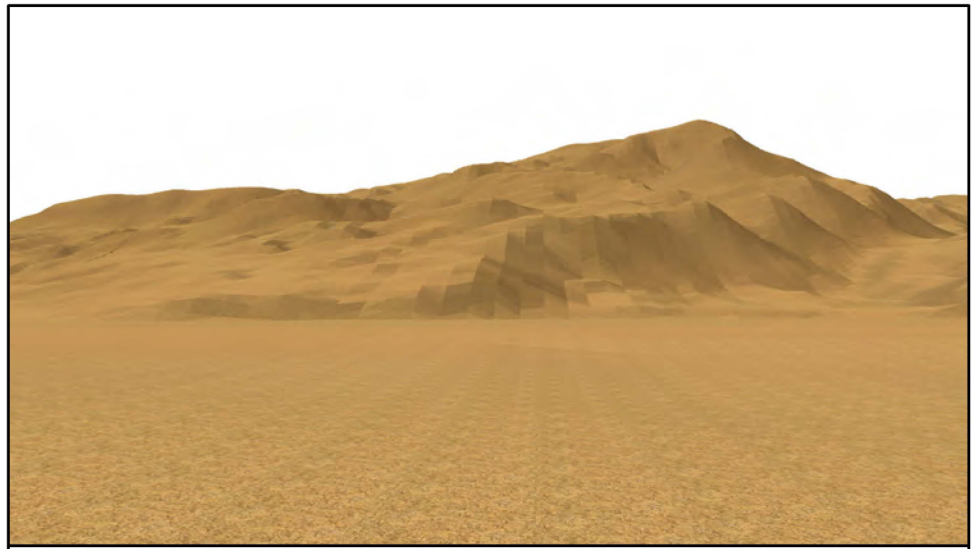
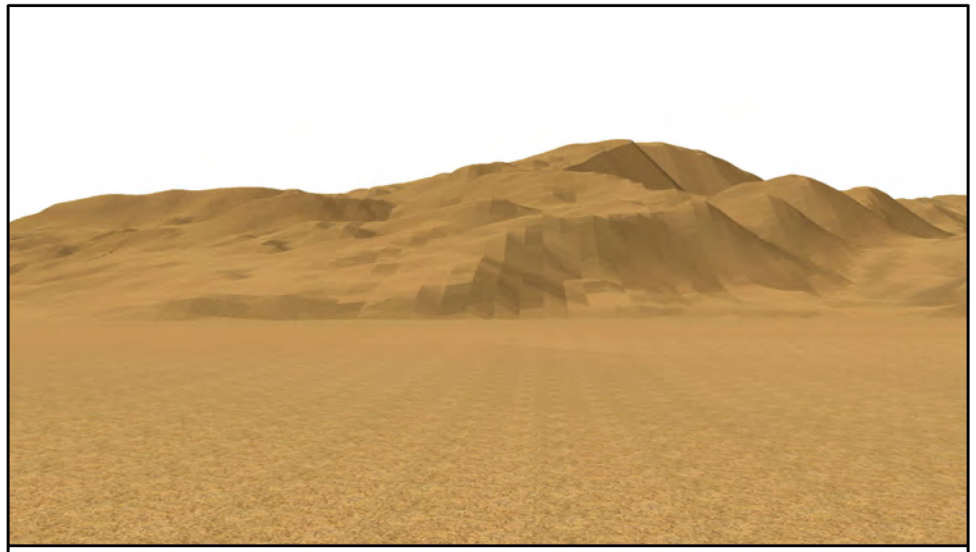
Figure H-5
Alternative A - Visual Simulation from KOP5



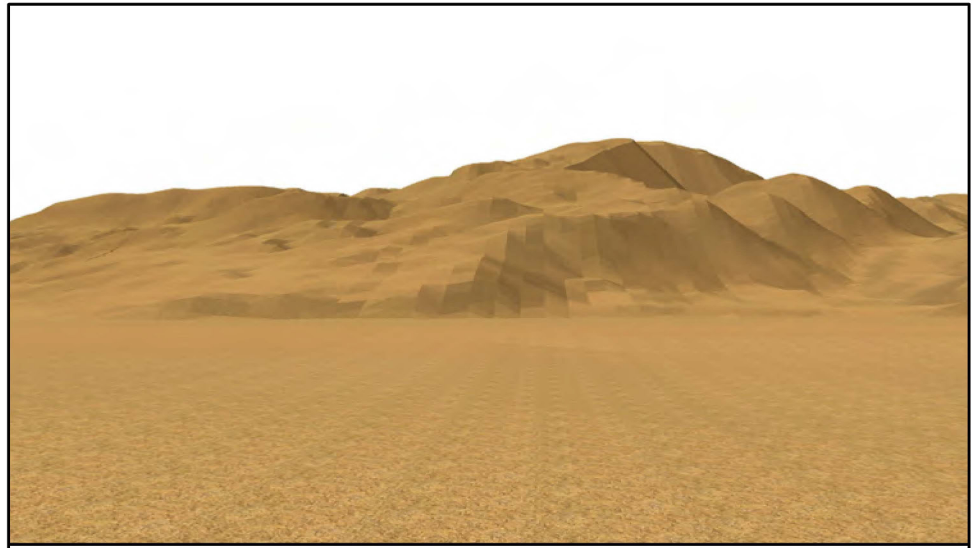
Existing Conditions - Google Earth



Existing Conditions - Carlson Topo



Phase 1



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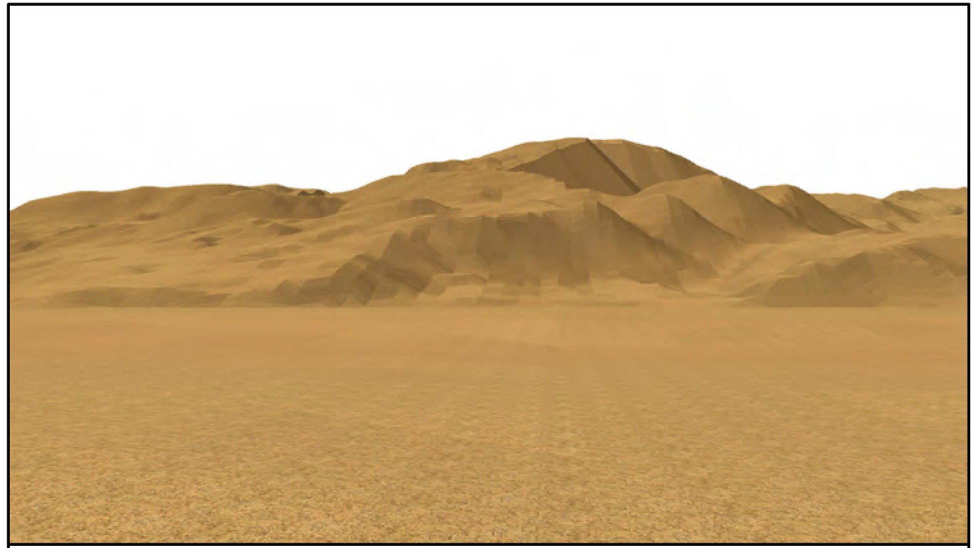

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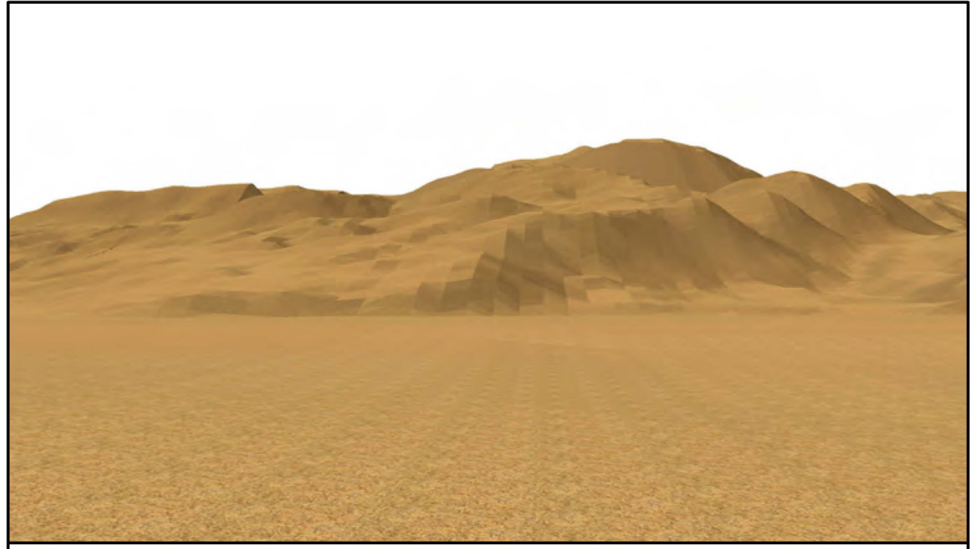

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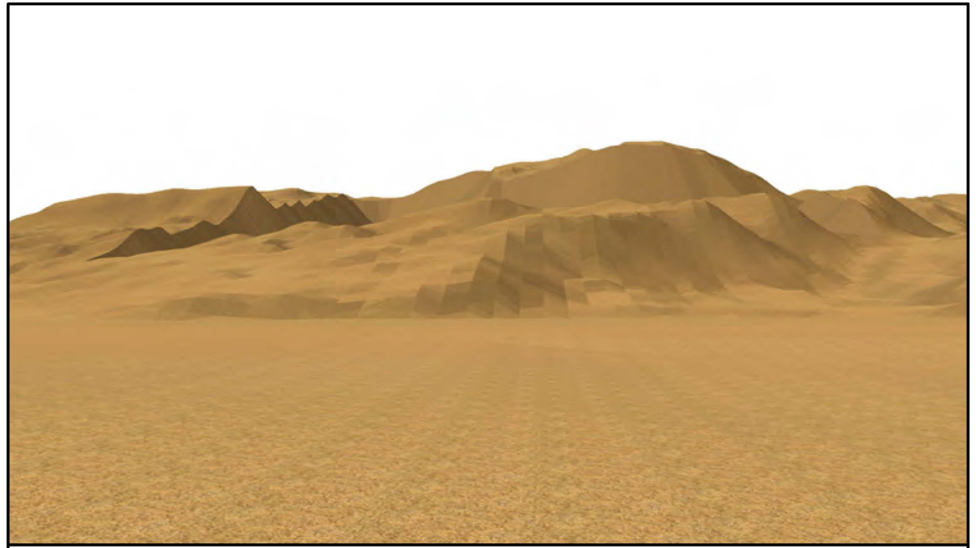

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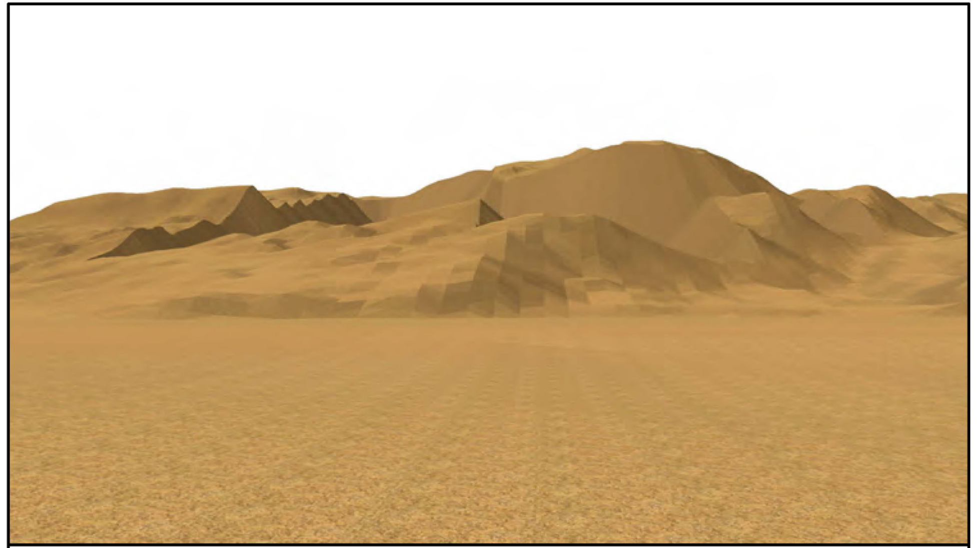

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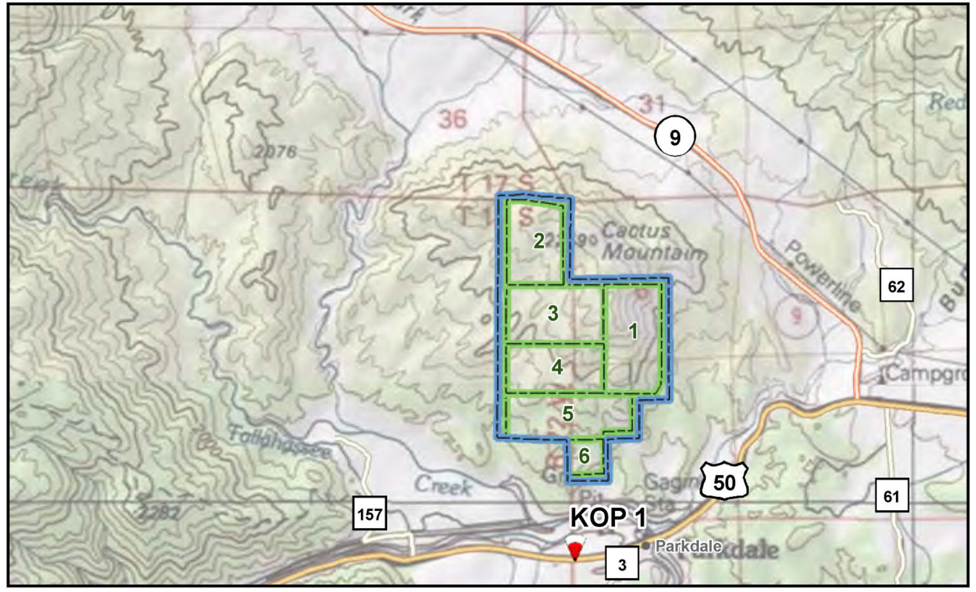

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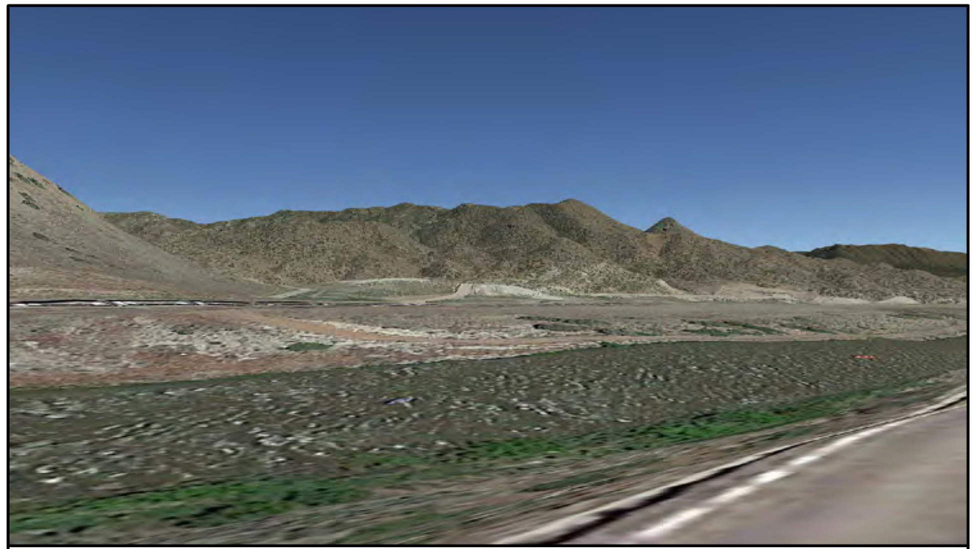
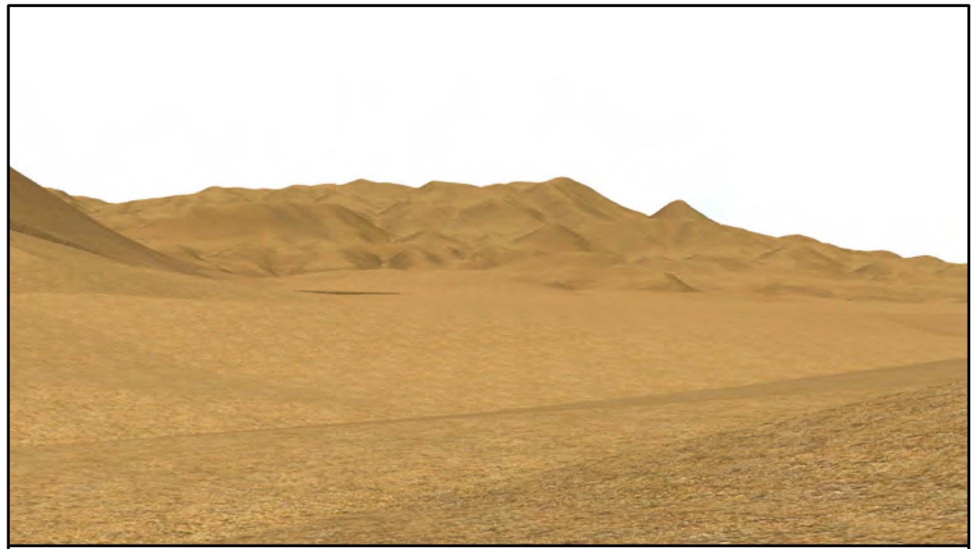
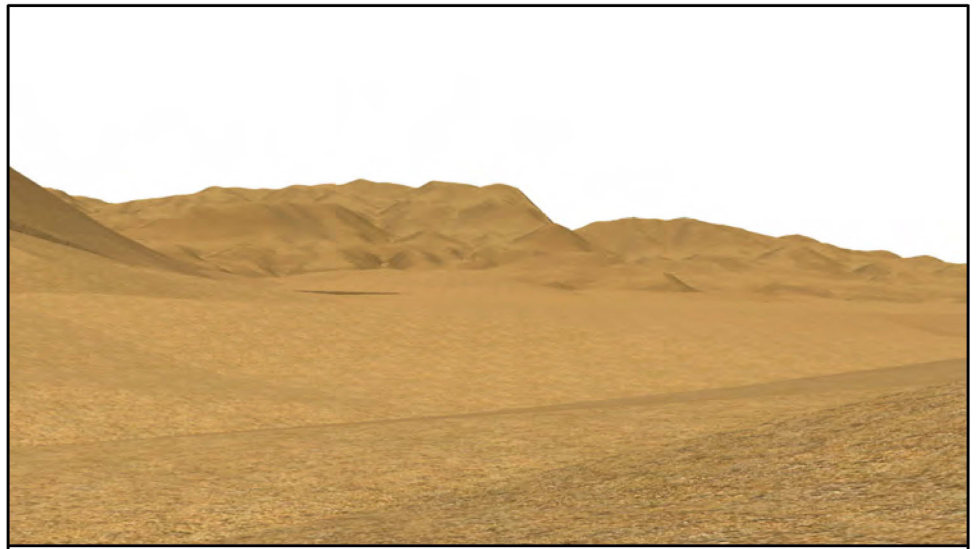
Figure H-6
Alternative C - Visual Simulation from KOP1


Existing Conditions - Google Earth


Existing Conditions - Carlson Topo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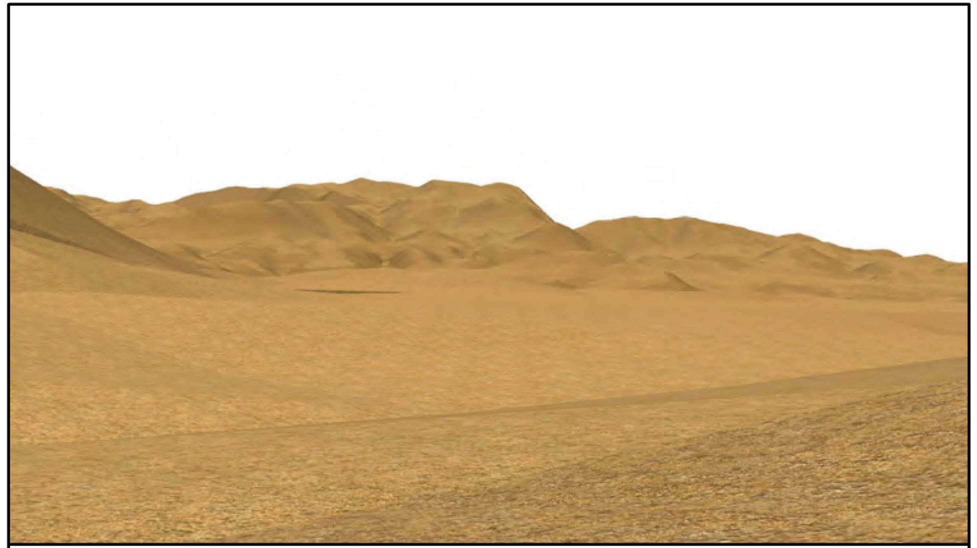
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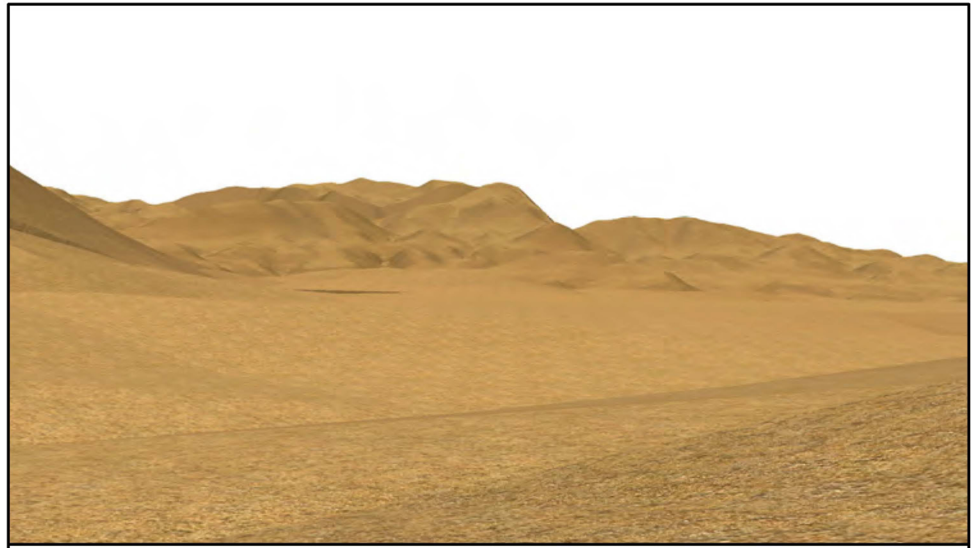
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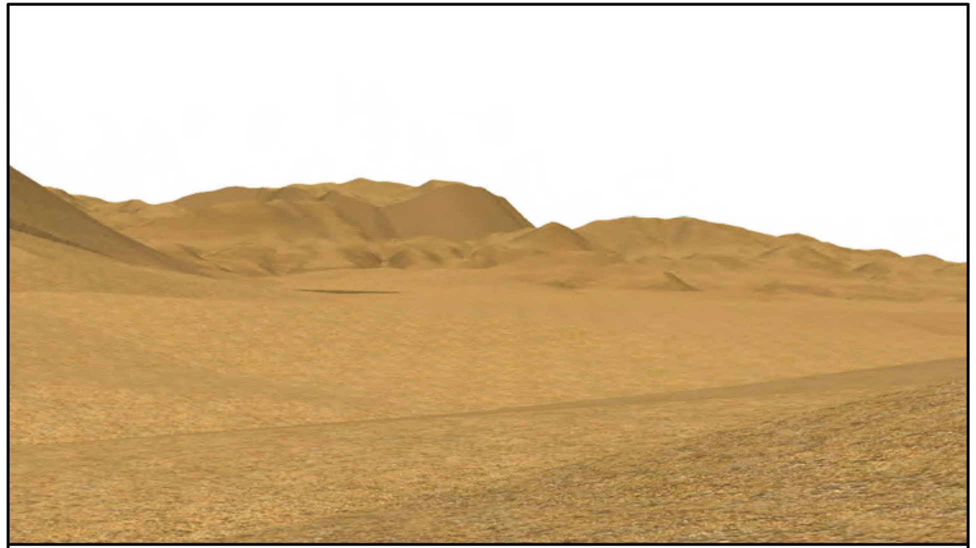
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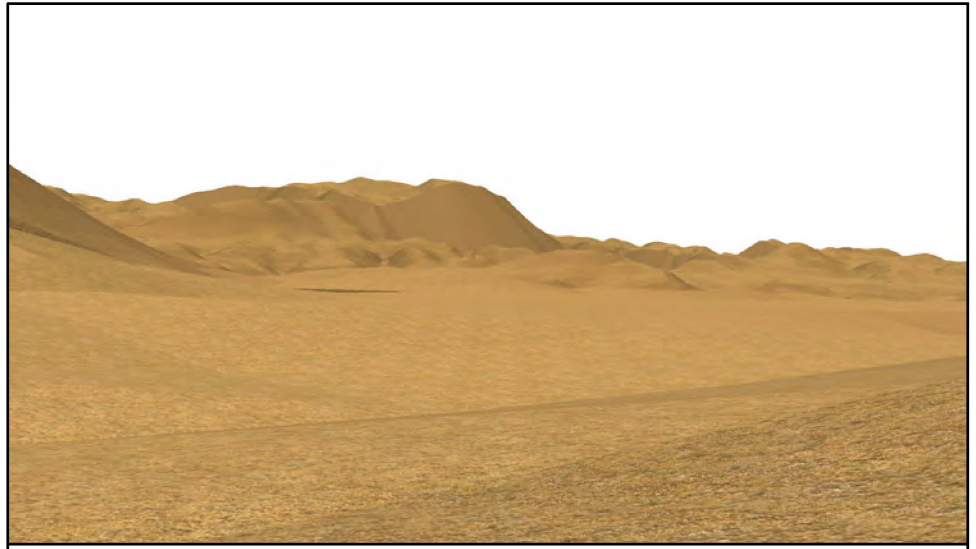
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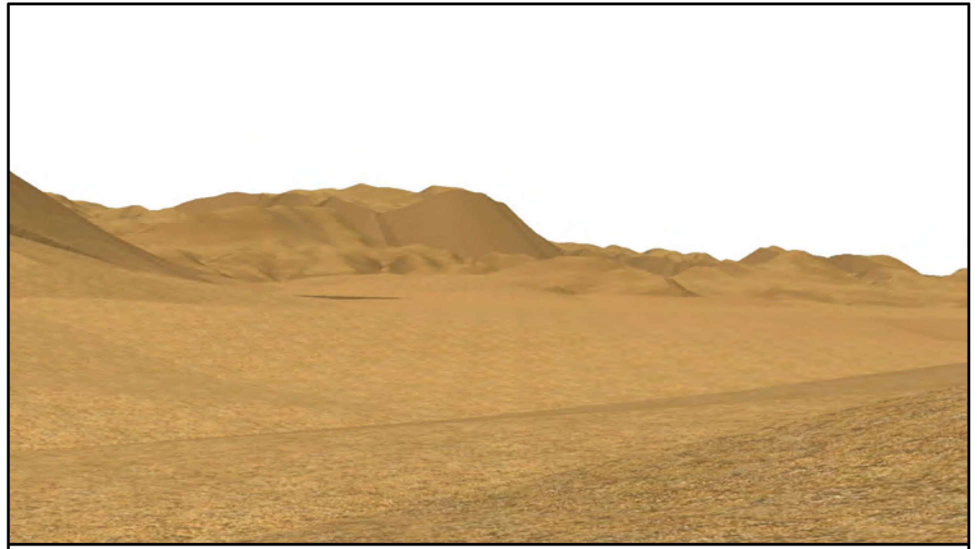
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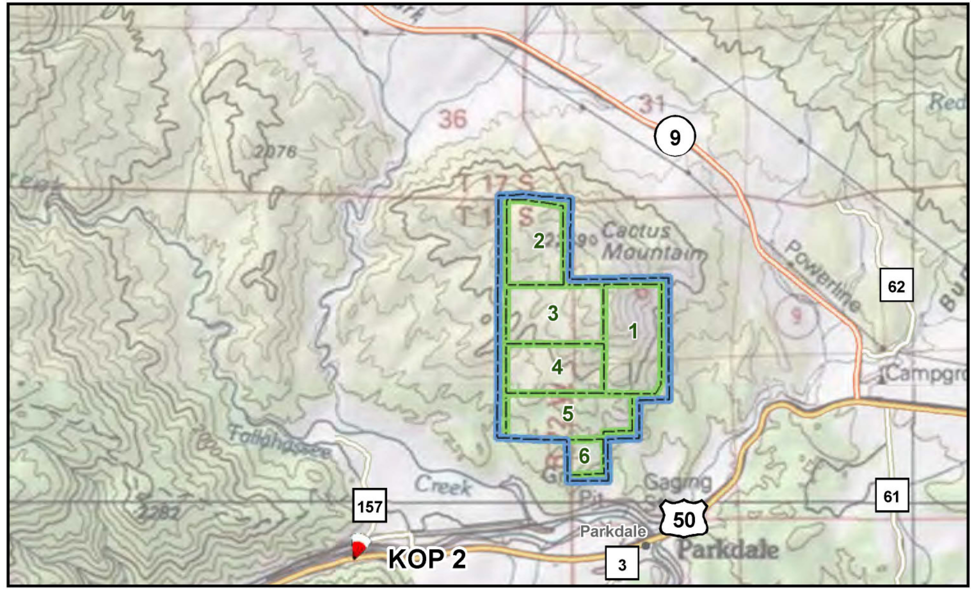

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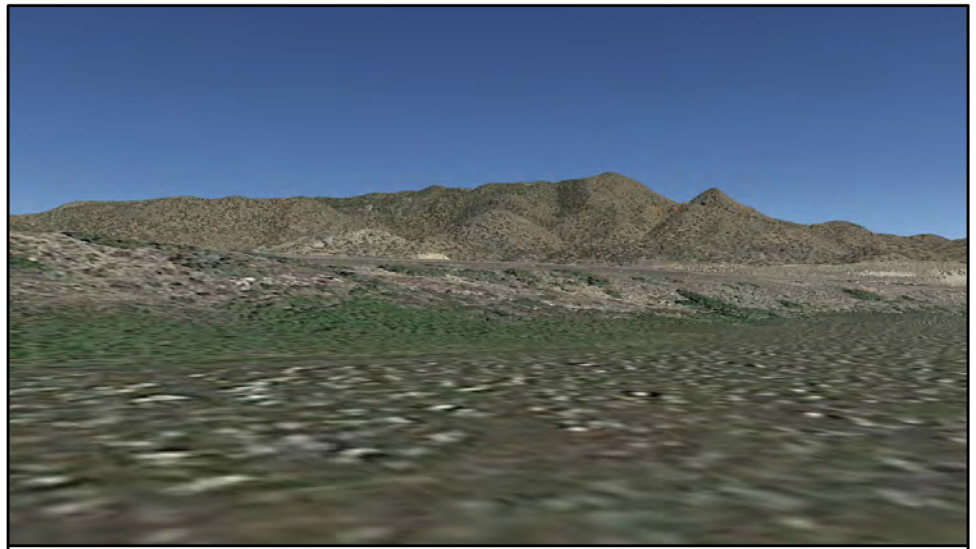
Figure H-7
Alternative C - Visual Simulation from KOP2



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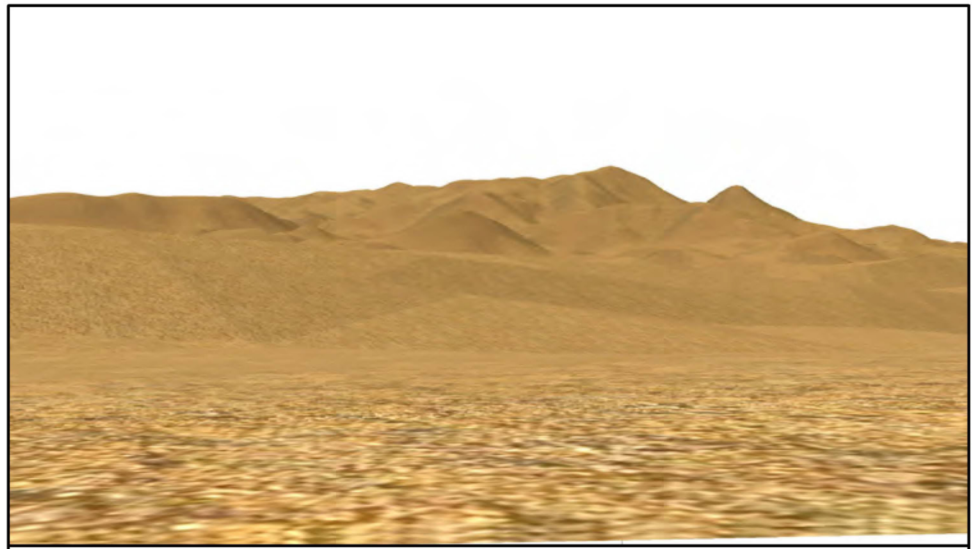

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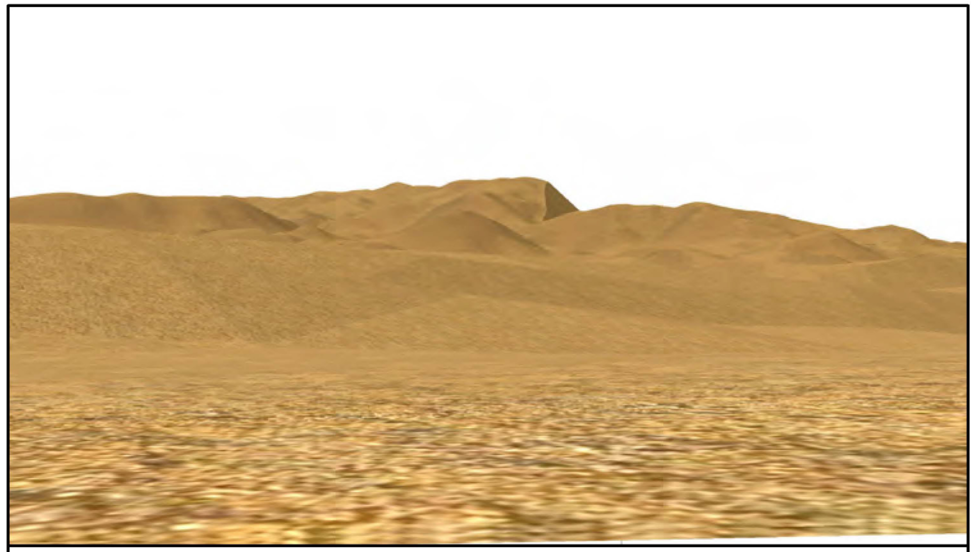

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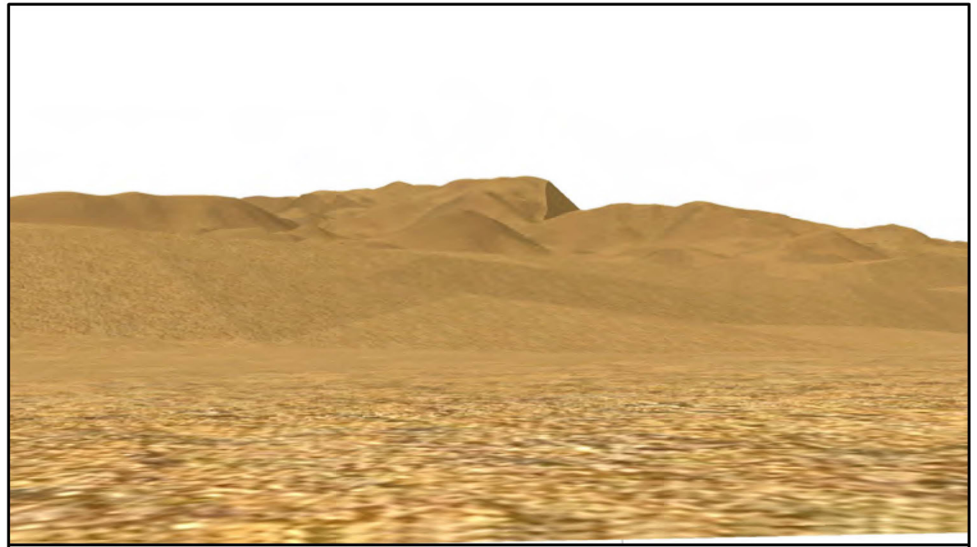

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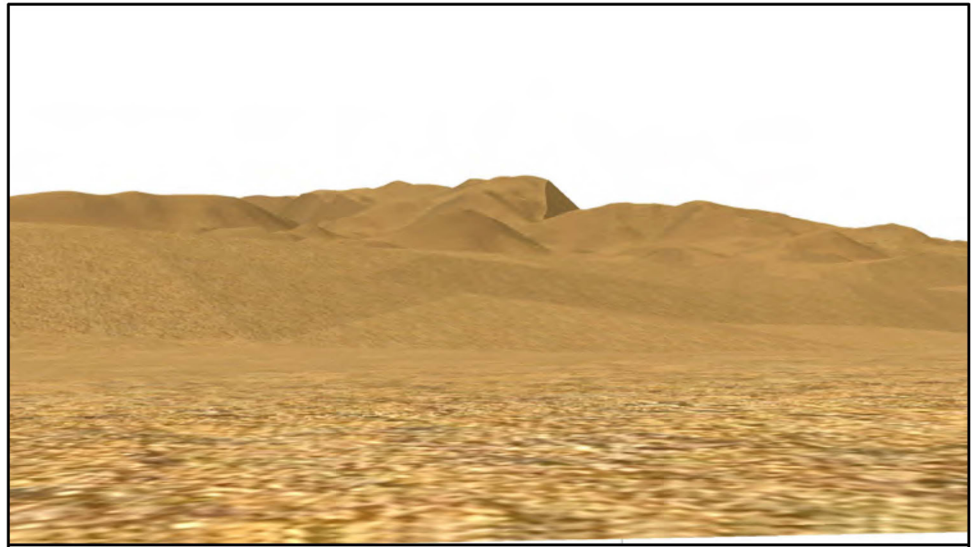

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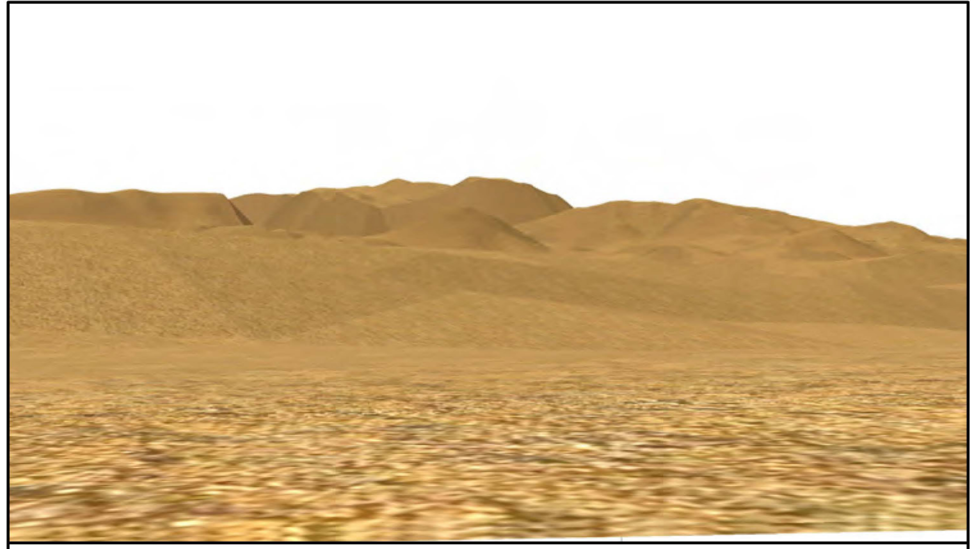

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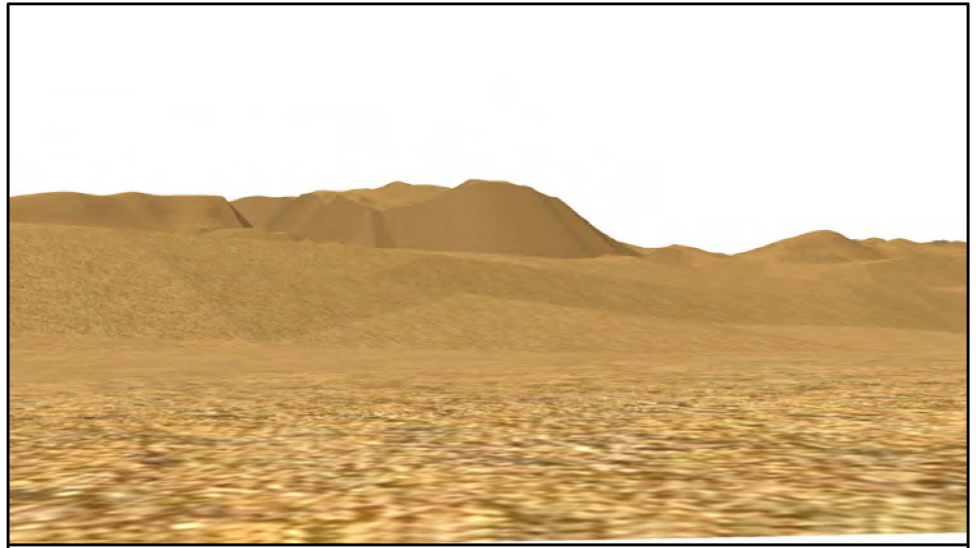

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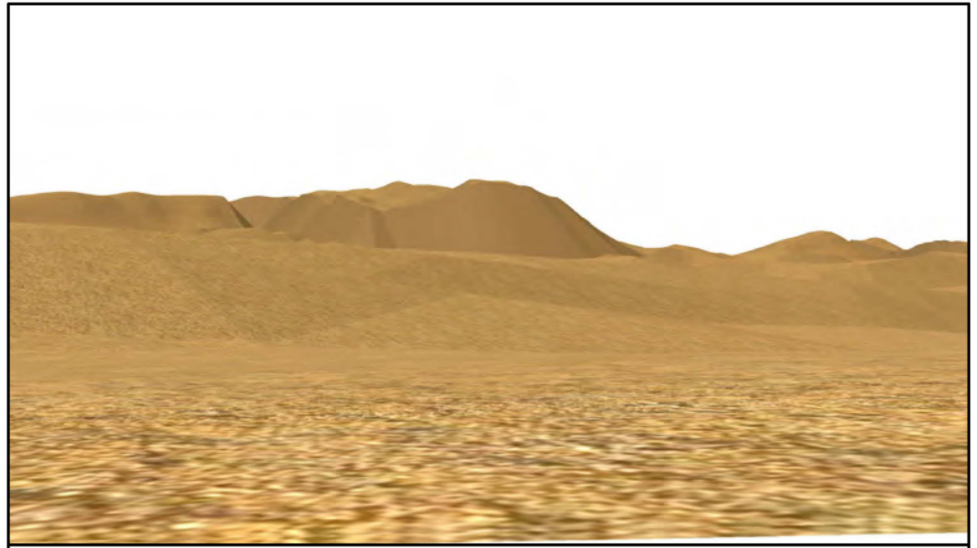

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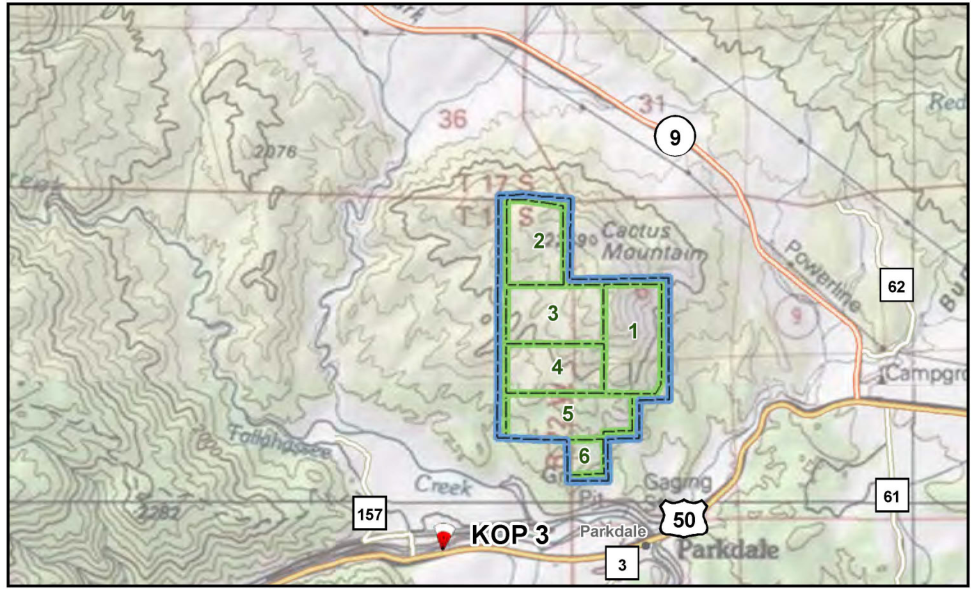

**Figure H-8**
**Alternative C - Visual Simulation from KOP3**

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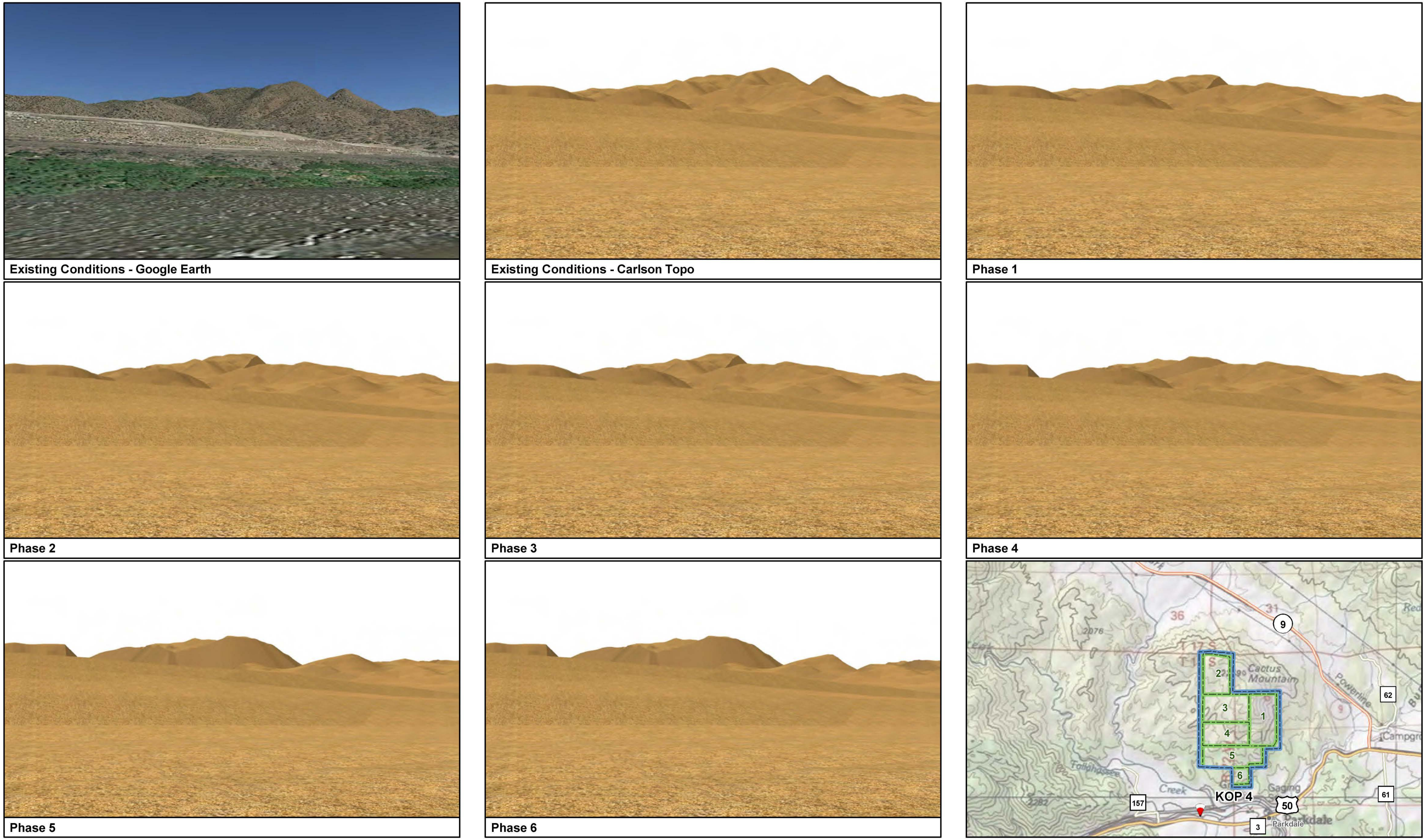

Existing Conditions - Google Earth

Existing Conditions - Carlson Topo

Phase 1

Phase 2

Phase 3

Phase 4

Phase 5

Phase 6

## Figure H-9
## Alternative C - Visual Simulation from KOP4

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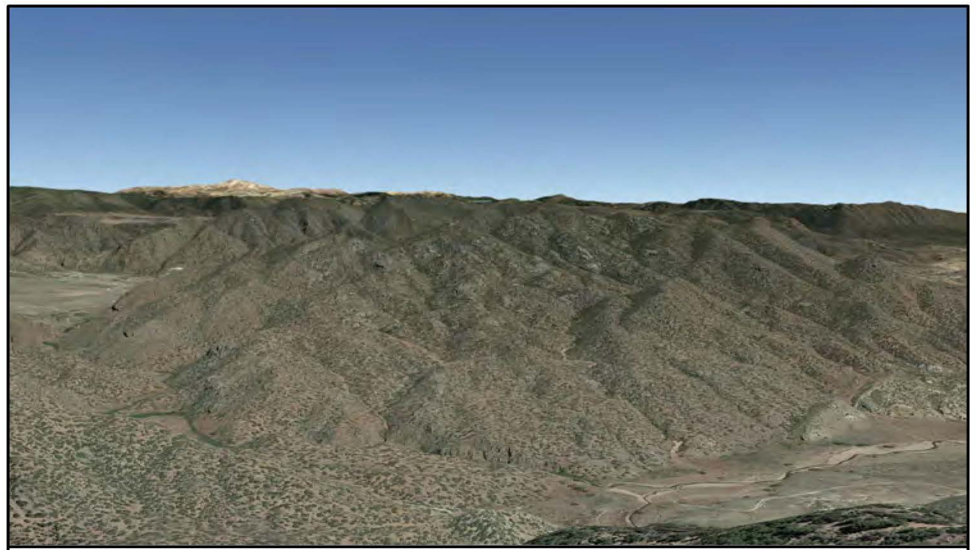
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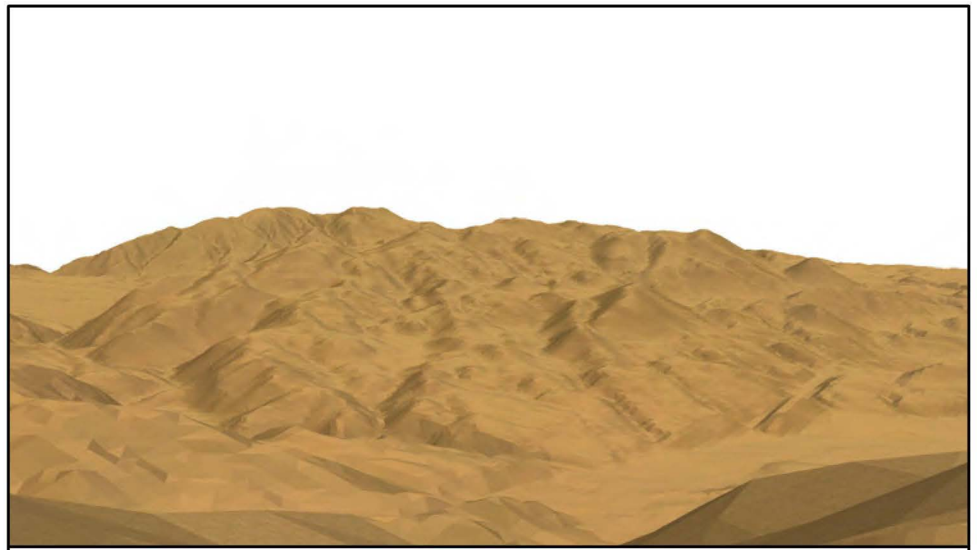
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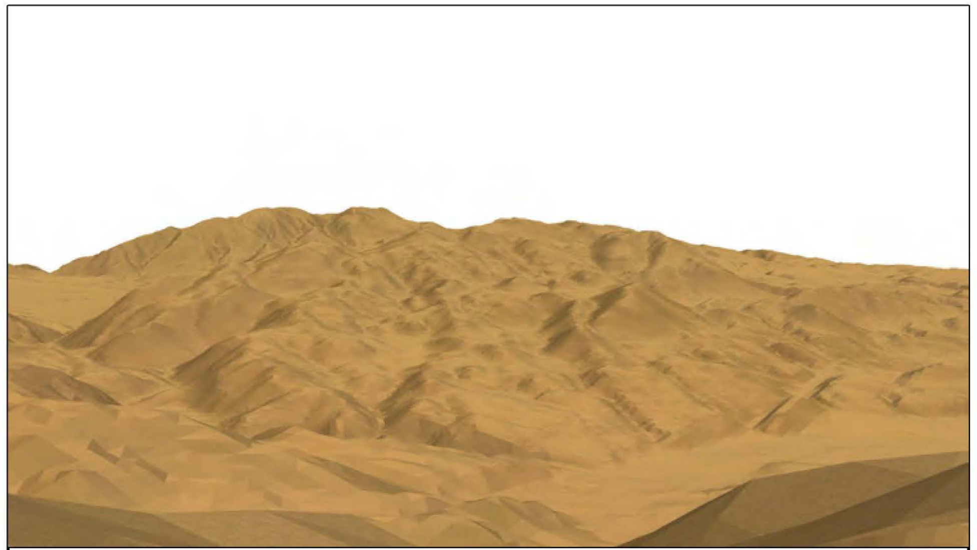
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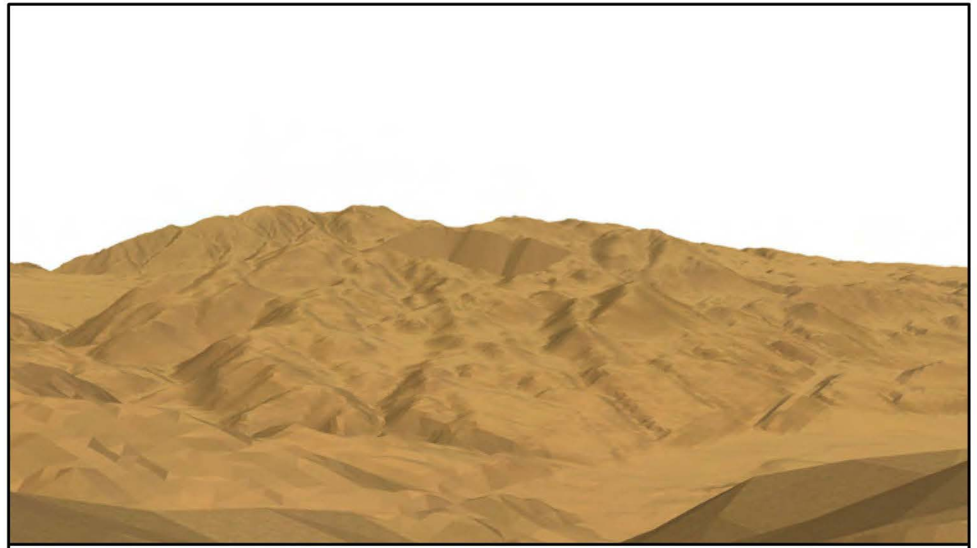
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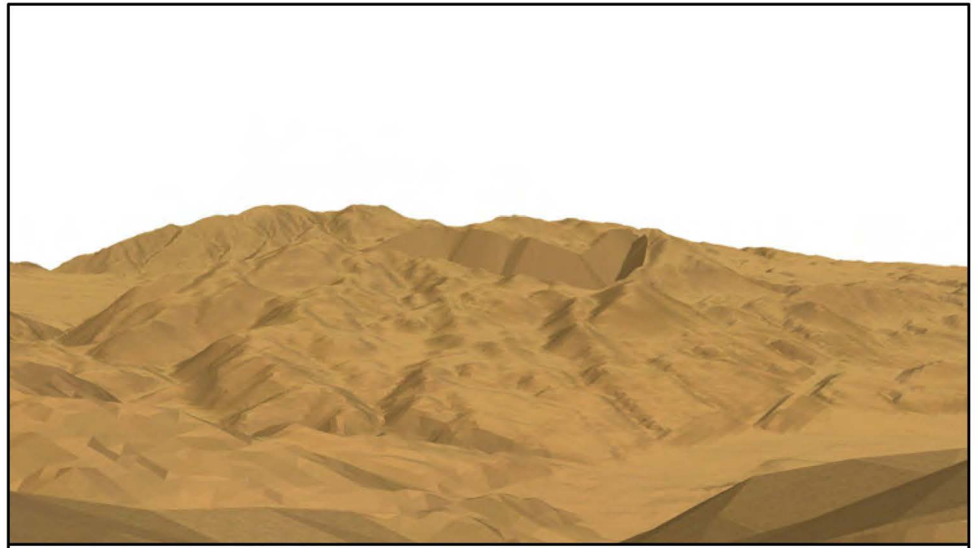
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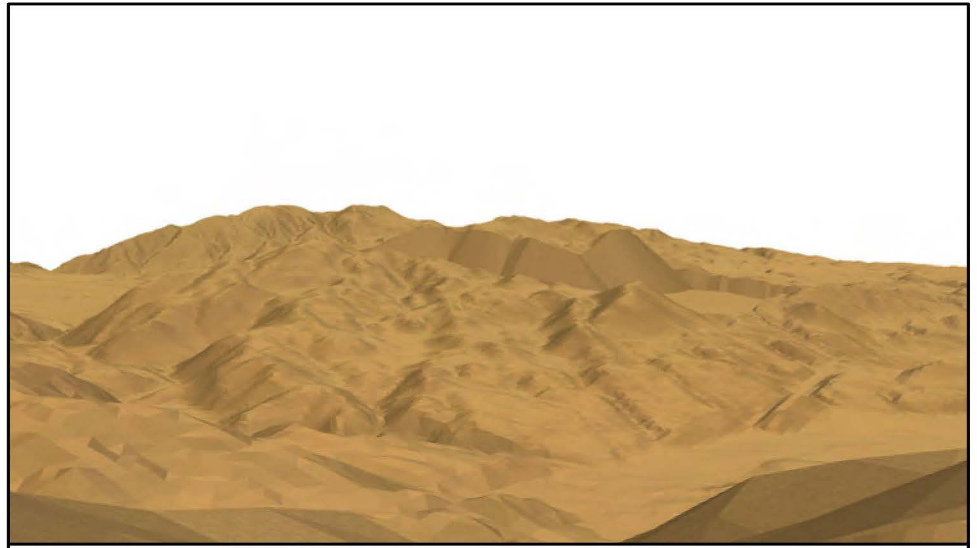
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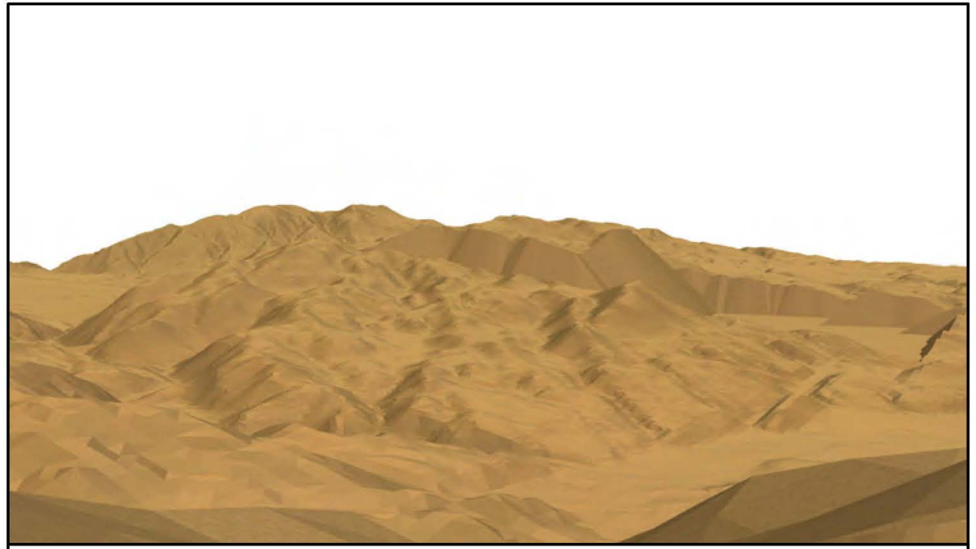
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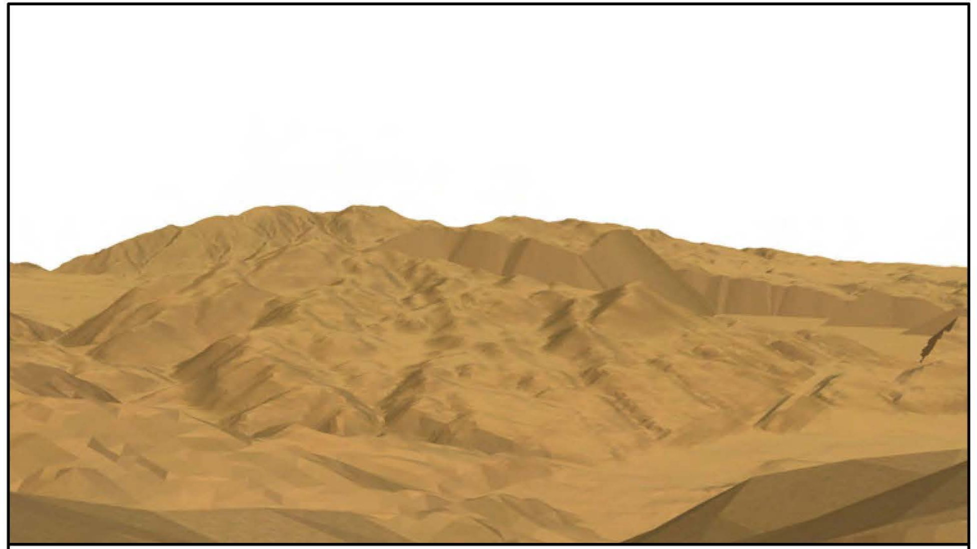
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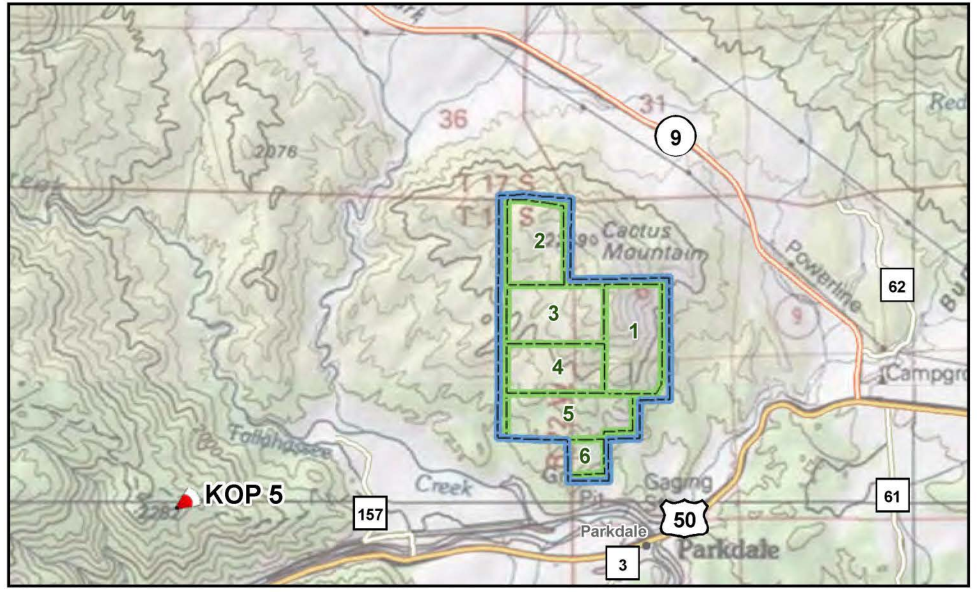

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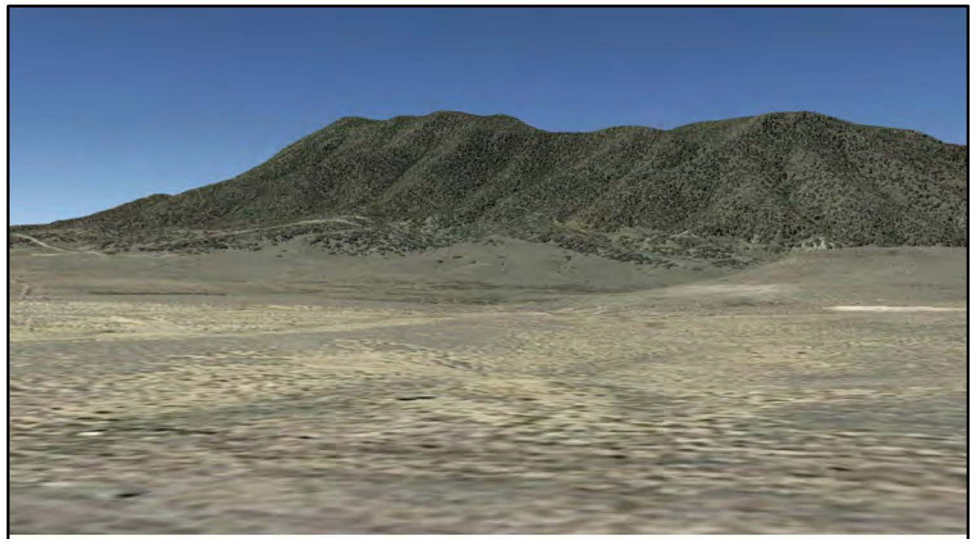
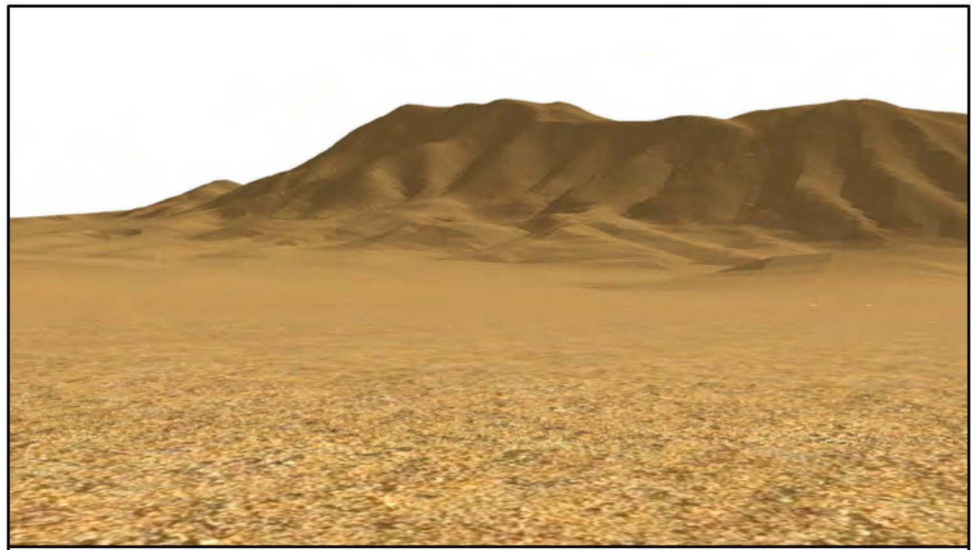
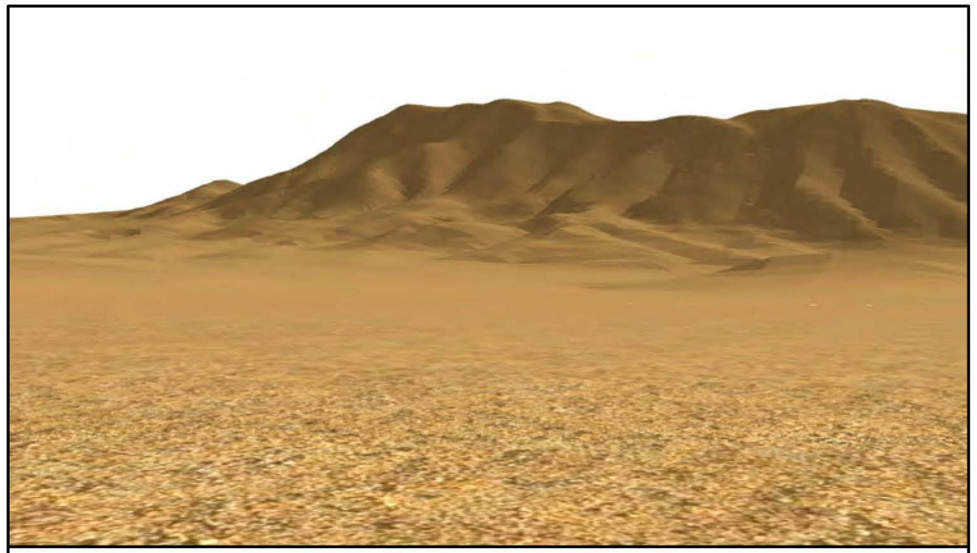
Figure H-10
Alternative C - Visual Simulation from KOP5



Existing Conditions - Google Earth



Existing Conditions - Carlson Topo



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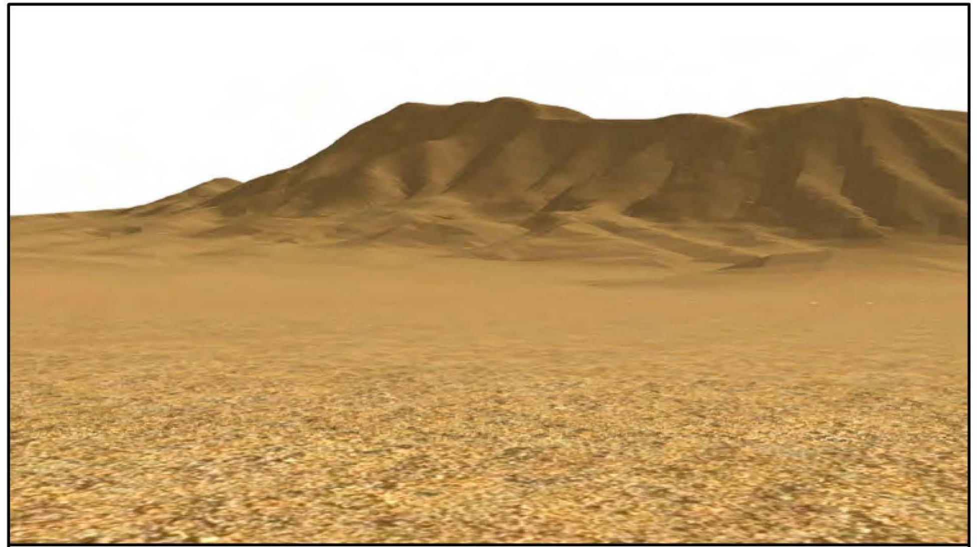

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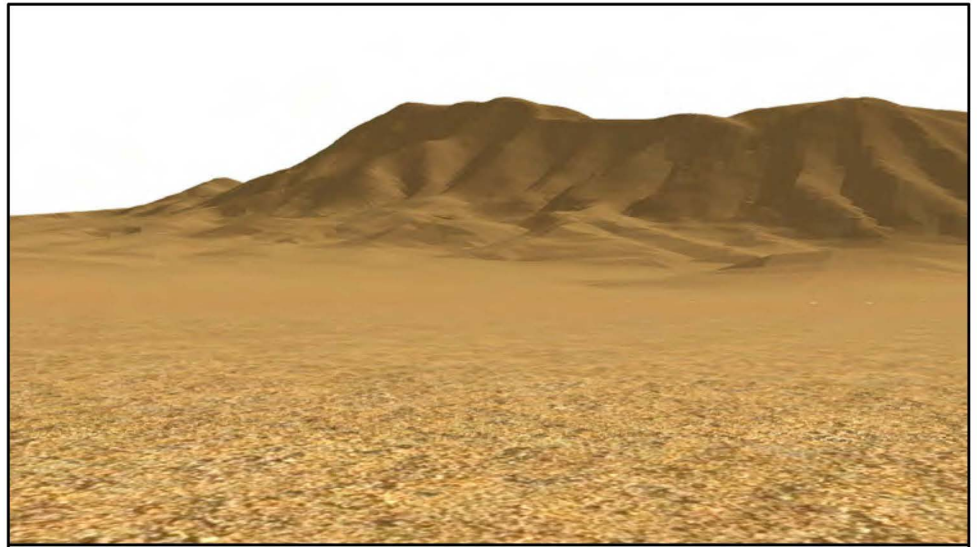

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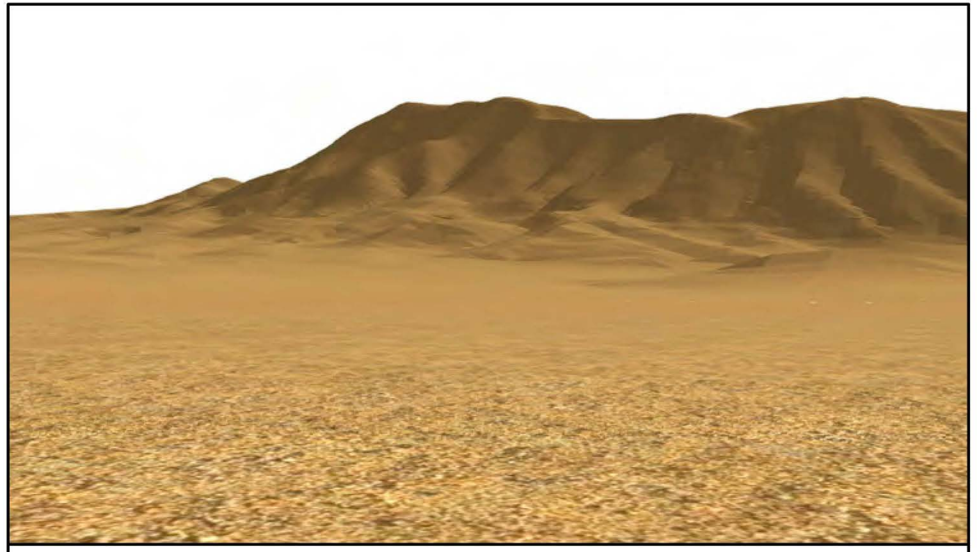

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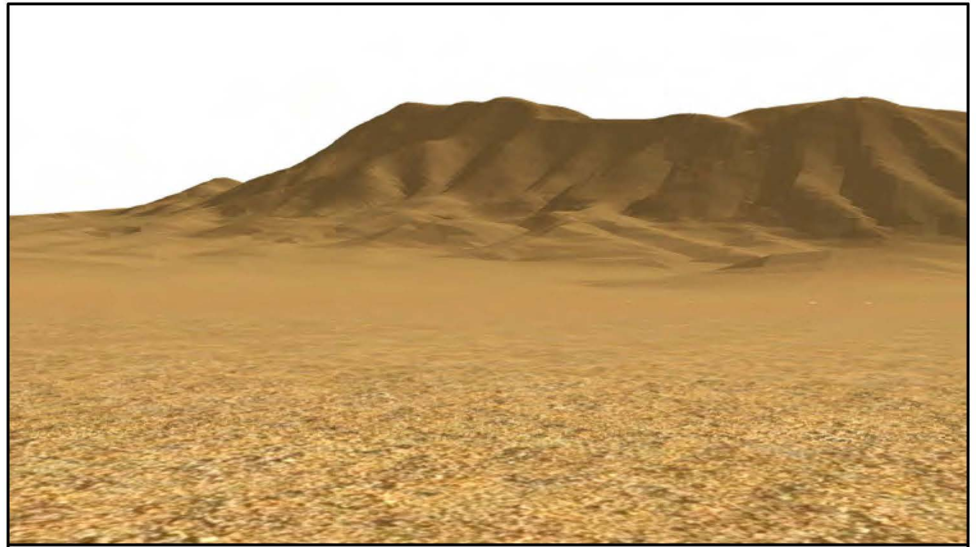

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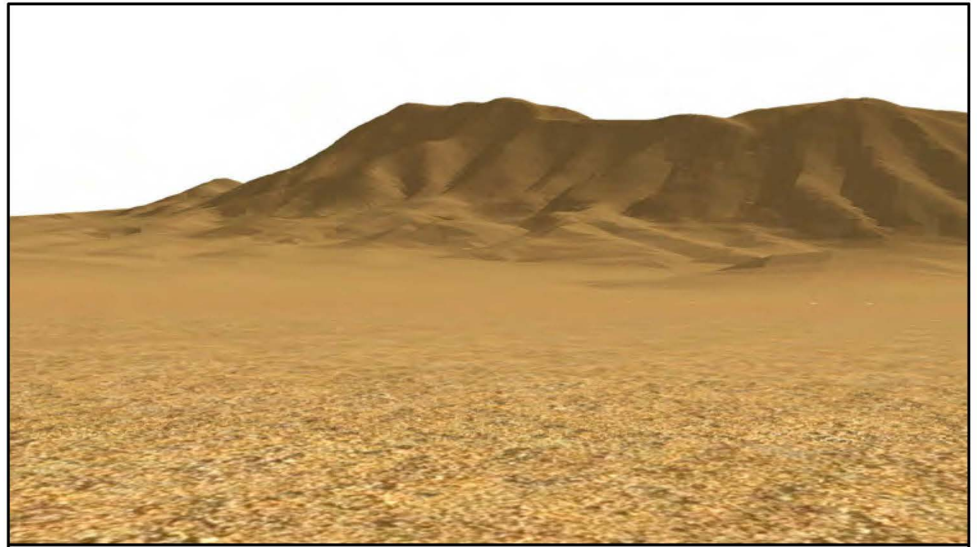

Phase 6

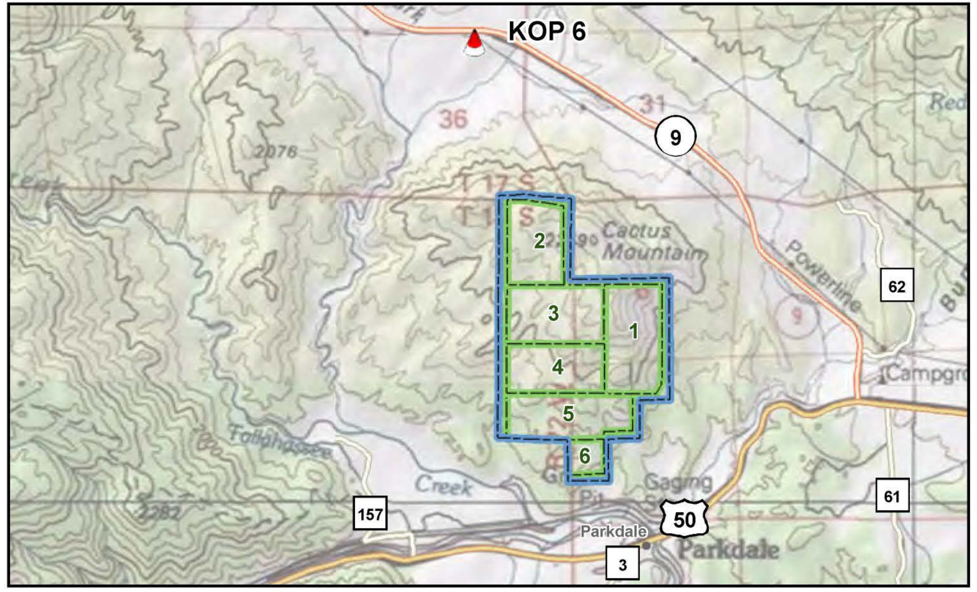

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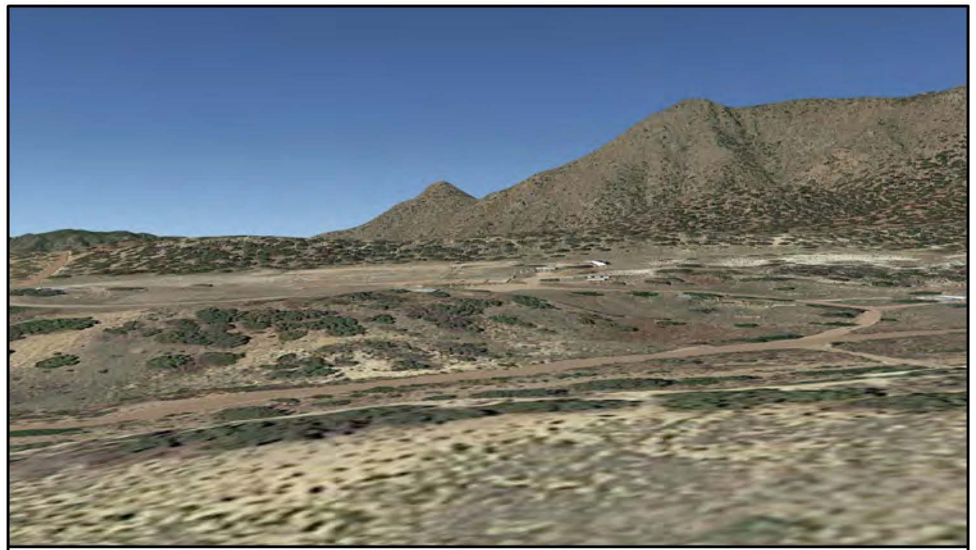
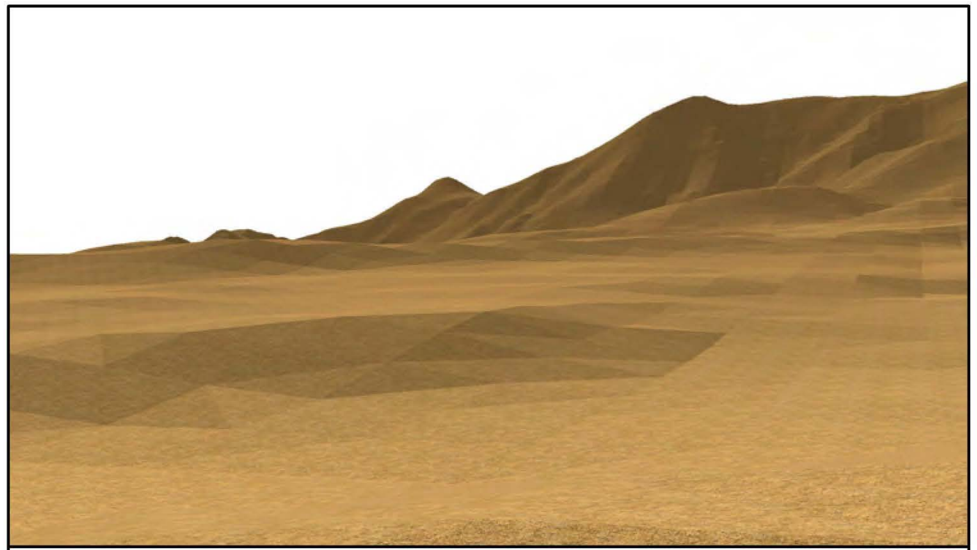
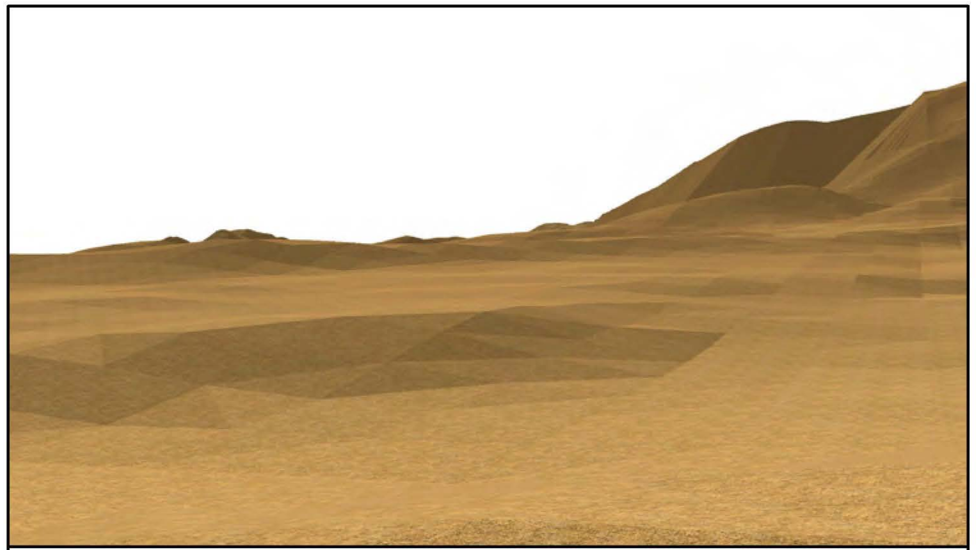
**Figure H-11**
**Alternative C - Visual Simulation from KOP6**


Existing Conditions - Google Earth


Existing Conditions - Carlson Topo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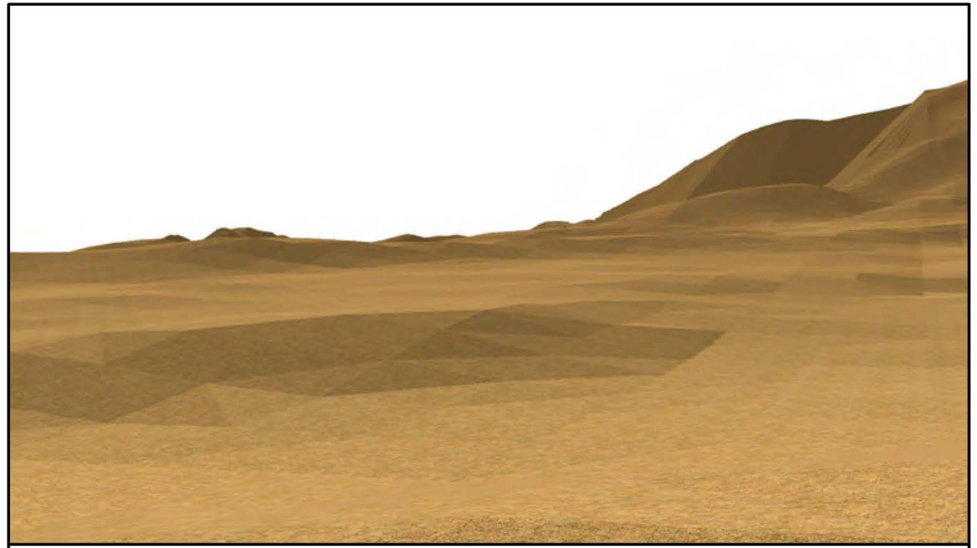
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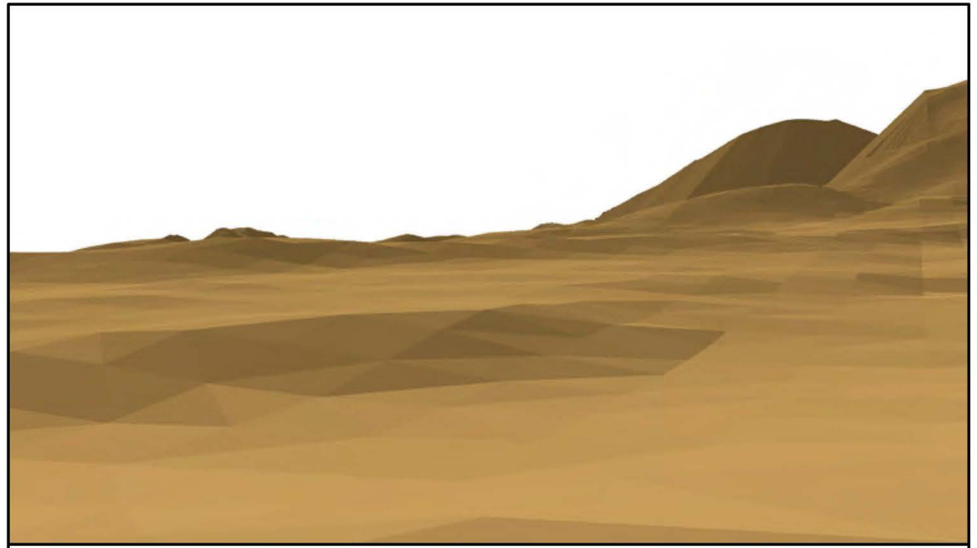
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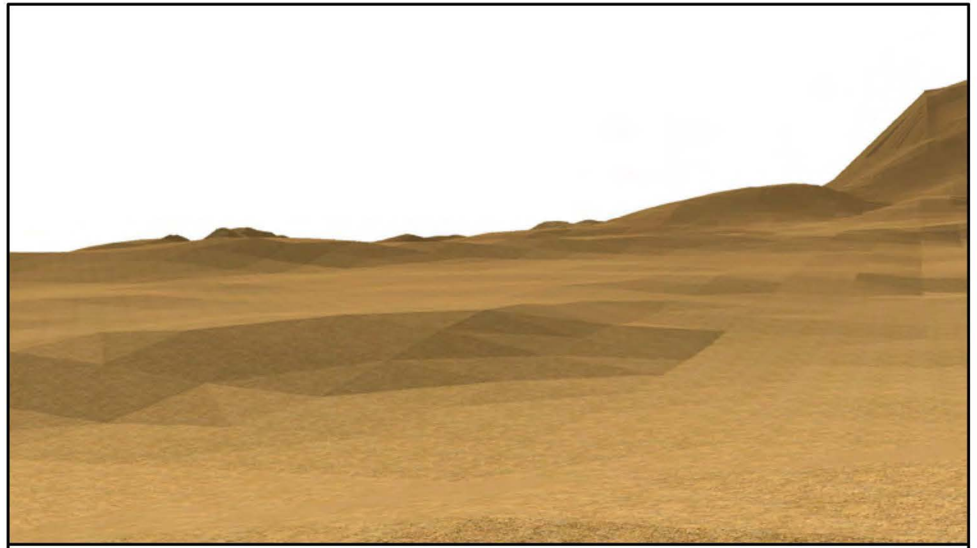
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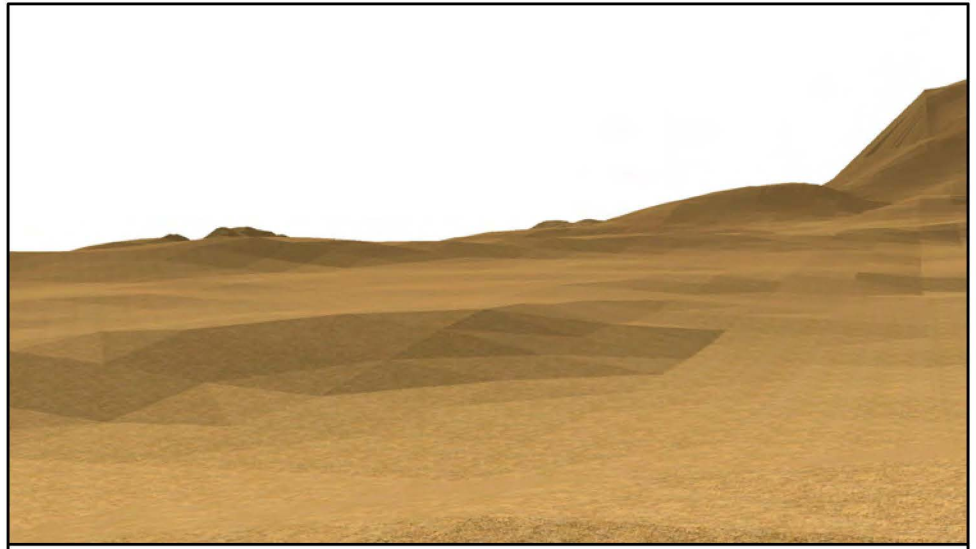
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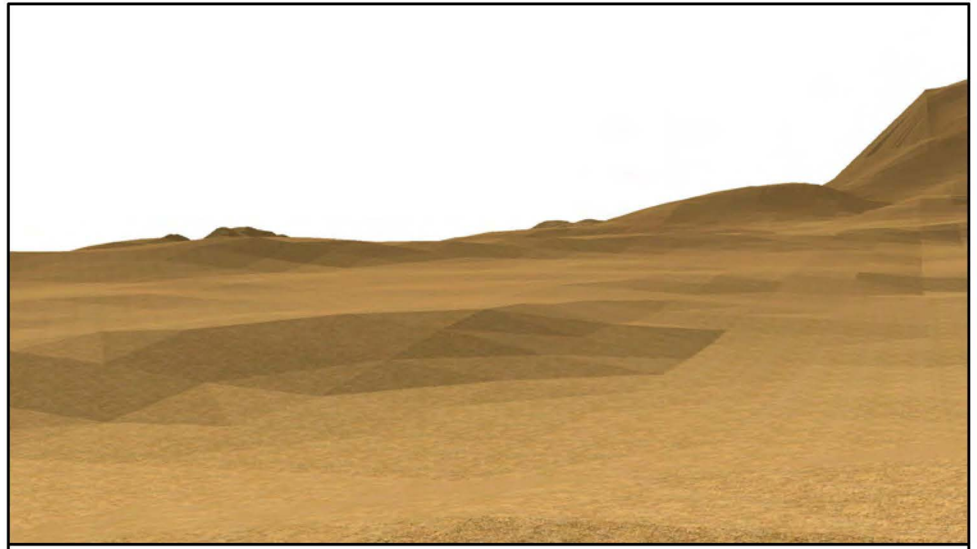
Phase 6

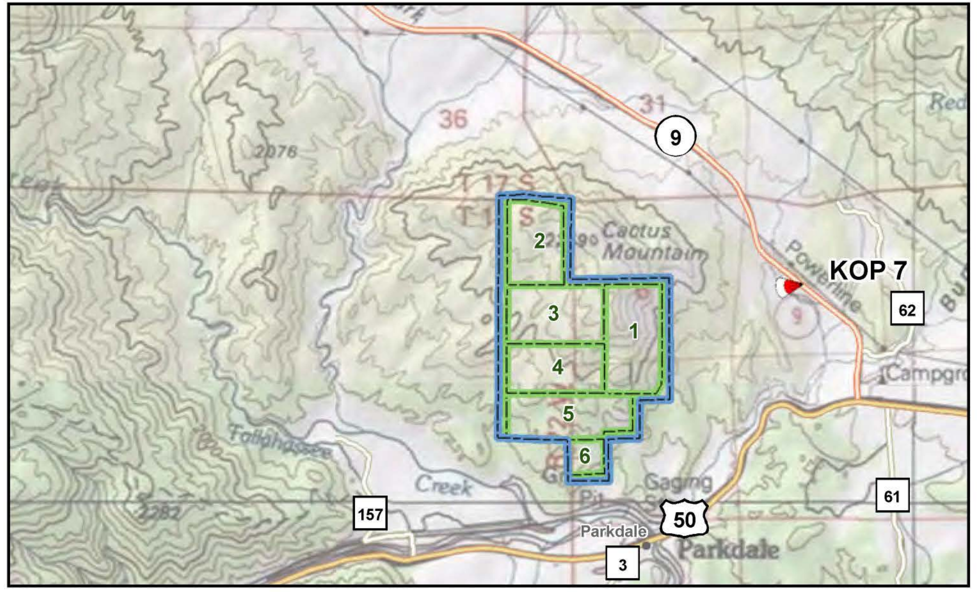

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Figure H-12
Alternative C - Visual Simulation from KOP7

***Draft Environmental Impact Statement***
***Parkdale Quarry Expansion Project***

# *Appendix I*

Socioeconomics Impact Analysis

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# APPENDIX I. SOCIOECONOMICS IMPACT ANALYSIS

## 1.1 ECONOMIC IMPACT ANALYSIS

The analysis of economic impacts from the Parkdale Quarry's Mineral Materials Sale quantified the effects of the proposed quarry expansion on key socioeconomic indicators, including employment, output (production of goods and services), among others. The employment and output supported by the proposed quarry expansion was modeled using IMPLAN (IMpact Analysis for PLANning).

This section describes the methods and results of the regional economic modeling for the Parkdale Quarry EIS. IMPLAN is one of the most widely used input-output modeling systems in the United States (IMPLAN, 2019), and it was used to estimate the economic impact for Alternative A (Proposed Action), that was analyzed in the Parkdale Quarry EIS. IMPLAN is a regional economic model that provides a mathematical accounting of the flow of money, goods, and services through a region's economy—for this analysis, the region is Fremont County, Colorado.

### 1.1.1 Key Concepts and Terminology

A variety of tools are available to estimate regional economic impacts, but by far the most widely used today are input-output models. These models are generally static input-output models used to analyze the effects of an economic stimulus (in the form of a specific policy or project) on an economic region. Regional economic models are called input-output models because the inputs (purchases) of one industry represent the outputs (sales) of other industries. Input-output models such as the IMPLAN model provide a quantitative representation of the production relationships between individual economic sectors and provide estimates of how a specific economic activity translates into jobs and income for the region.

Expansion of quarry operations onto BLM lands north of the existing Parkdale Quarry would represent a new source of demand for local materials and generate local employment and income. Supply linkages between different sectors of the economy allow some local businesses to meet some of the needs associated with the facilities as well as the consumer needs associated with workers directly employed by Martin Marietta and with workers employed by vendors in the supply chain. These supply linkages and local worker expenditures represent a secondary source of local employment and income. The various rounds of local expenditures and earnings followed by additional expenditures and earnings affect many sectors of the local economy and result in total generated employment and income that is a "multiple" of the original direct increase in demand for labor and materials. Public sector revenues are also affected in the form of increased tax collections. Economists use economic modelling to describe the supply and demand linkages between the economic sectors that can be used to estimate the total effects of a direct increase in demand. These impacts are known as “multiplier effects.” The three primary categories of multiplier effects are the following:

- **Direct**—Direct effects represent the impacts due to the investments that result in final demand changes.
- **Indirect**—Indirect effects represent the impacts due to the inter-industry linkages caused by the iteration of industries purchasing from other industries, brought about by the changes in final demands.
- **Induced**—Induced effects represent the impacts on all local industries due to consumers’ consumption expenditures arising from the new household incomes that are generated by the direct and indirect effects of the final demand changes.

### 1.1.2 IMPLAN Description

The IMPLAN model is created and maintained by the Minnesota IMPLAN Group and was developed in the 1970s through a collaboration with the U.S. Department of Agriculture, Forest Service and the University of Minnesota (IMPLAN, 2019). The IMPLAN model is constructed with data from the U.S. National Income and Product Accounts and the Bureau of Economic Analysis (BEA), among a variety of other data sources. The model includes 536 industry sectors based on the North American Industry Classification System (NAICS). The IMPLAN support team annually updates county-level databases that report such attributes as:

- Industries present in the regional economy;
- Output, employment, and income levels accounted for by each industry;
- Main sources of residents’ incomes;
- Inter-industry commodity purchases;
- Shares of inter-industry inputs purchased locally; and
- Industries that produce commodities exported from the region (i.e., that compose the region’s economic base).

The model uses region-specific multipliers to trace and calculate the flow of dollars from the industries that originate the impact to supplier industries. The results of this analysis are reported using the following metrics:

- **Employment:**[1] Represents the jobs created by industry, based on the output per worker and output impacts for each industry.

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[1] Due to the static nature of the IMPLAN model, the employment impacts are presented in terms of annual job-years as the model calculates the annual impact of annual activity. It is likely that once the job is created, it will be sustained; however to ensure that the impact is not overstated, it is conservatively assumed that the job impact is annual.

- **Labor Income**: Includes all forms of employment income, including employee compensation (wages and benefits) and proprietor income.
- **Value added or Gross State Product**: The difference between an industry's total output and the cost of its intermediate inputs; is the state-level counterpart to gross domestic product.
- **Industry Activity**: Represents the total economic output generated by the direct spending.

This analysis used IMPLAN data for Fremont County, Colorado from 2017, the most recent year for which data were available when the analysis was conducted. Data were processed using IMPLAN Version 3.1 software (IMPLAN, 2019).

### 1.1.3 Methodology/IMPLAN Inputs

IMPLAN provides a systematic methodology for analyzing scenarios that represent the direct economic output or employment effects associated with specific management actions. The direct impacts, or the initial economic drivers that produce an overall change in economic activity that can be quantified to produce estimates of the indirect, induced, and total economic effects of the alternative being analyzed.

The economic impact analysis evaluates Alternative A, the Proposed Action. The gross regional product or value-added for the Fremont County economy was approximately $1.4 billion according to the IMPLAN model year 2017 data.

The economic impact analysis evaluates Alternative A, i.e., if the mine plan and competitive contract for the sale of mineral materials is approved by BLM. The analysis used the input of the proposed increase in operational employment and its effects in 2024 dollars. Results over the life of Alternative A have been deflated and are presented in 2019 dollars. Martin Marietta provided direct employment estimates for Alternative A, as described in Section 3.9, *Socioeconomic Conditions*.

The model inputs for Alternative A are exclusively the expected additional employment to both the Parkdale Quarry Mine and the Rock and Rail Railroad. Monetary spending on capital equipment is not modeled due to the additional spending on Alternative A from Alternative B, $30 million, is to be spent on equipment alone which is manufactured outside of the study area. **Table I-1** shows the direct employment low and high scenario under Alternative A.

**Table I-1. Direct Employment Activity Under Alternative A**

| Activity | IMPLAN Field | Proposed Action – Low | Proposed Action – High |
|---|---|---|---|
| ***Operational Expenditures*** | | | |
| Parkdale Quarry Mine – Additional Employment | Stone Mining and Quarrying | 10 | 20 |
| Rock and Rail Railroad – Additional | Rail | 6 | 10 |

**Table I-1. Direct Employment Activity Under Alternative A**

| Activity | IMPLAN Field | Proposed Action – Low | Proposed Action – High |
|---|---|---|---|
| Employment | Transportation | | |
| | **Total Additional Employment** | **16** | **30** |

Source: Martin Marietta, Parkdale Quarry Coordination Meeting, 2019

### 1.1.4 IMPLAN Results

For Alternative A, an increase in direct operational employment would increase, as depicted in **Table I-1**. Under the "low estimate" for direct additional employment, the alternative would support over 26 jobs, $1.9 million of labor income, and $6.2 million of regional output. Results of the IMPLAN analysis for the "low estimate" are shown in **Table I-2**.

**Table I-2. Annual Economic Effects for Alternative A's Operational Phase – Low Estimate**

| Impact Type | Employment[1] | Labor Income[2] | Total Value Added[2] | Output[2] |
|---|---|---|---|---|
| Direct Effect | 16 | $1,585 | $3,619 | $4,964 |
| Indirect Effect | 4 | $139 | $213 | $502 |
| Induced Effect | 6 | $203 | $421 | $780 |
| **Total Effect** | **26** | **$1,927** | **$4,253** | **$6,247** |
| Multiplier | 1.6 | 1.2 | 1.2 | 1.3 |

[1] Rounded to the nearest whole job.
[2] In thousands of 2019 dollars per year.

Under the "high estimate" for direct additional employment, the proposed action would support over 49 jobs, $3.45 million of labor income, and $11.5 million of regional output. Results of the IMPLAN analysis for the "high estimate" are depicted in **Table I-3**.

**Table I-3. Annual Regional Economic Effects for Alternative A's Operational Phase – High Estimate**

| Impact Type | Employment[1] | Labor Income[2] | Total Value Added[2] | Output[2] |
|---|---|---|---|---|
| Direct Effect | 30 | $2,827 | $6,692 | $9,164 |
| Indirect Effect | 7 | $260 | $400 | $945 |
| Induced Effect | 11 | $363 | $754 | $1,397 |
| **Total Effect** | **49** | **$3,450** | **$7,846** | **$11,506** |
| Multiplier | 1.6 | 1.2 | 1.2 | 1.3 |

---

[1] Rounded to the nearest whole job.
[2] In thousand of 2019 dollars per year.

IMPLAN also produces tax estimates. Under the “high estimate” for direct additional employment, the proposed action would raise over $1 million in taxes. Tax results of the IMPLAN analysis are depicted in **Table I-4**.

**Table I-4. Annual Regional Economic Effects for Alternative A’s Operational Phase – High Estimate**

| Tax Type | Alternative A – Low Estimate | Alternative A – High Estimate |
|---|---|---|
| State and Local Taxes | $181,275 | $333,309 |
| Federal Taxes | $465,073 | $842,846 |
| **Total Taxes** | **$646,348** | **$1,176,155** |

## 1.2 REFERENCES

IMPLAN. (2019). *Company*. Retrieved from IMPLAN: http://implan.com/company/.

Martin Marietta. (2017). Information from Martin Marietta. May 1, 2017. *Parkdale Quarry BLM Expansion Project Rationale.*

Martin Marietta. (2019). Employees' county of residence. August 22, 2019. (ICF, Interviewer).

Martin Marietta. (2019). Parkdale EIS Air RFI Responses. August 7, 2019. (ICF, Interviewer).

Martin Marietta. (2019). Parkdale Quarry Coordination Meeting. August 7, 2019. (ICF, Interviewer).

Resource Economics LLC. (2019). *Economic Impact of Proposed Parkdale Quarry Project.*

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# *Appendix J*

## Wildlife and Special Status Species

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# APPENDIX J. WILDLIFE AND SPECIAL STATUS SPECIES TABLES

## Table J-1. Migratory Birds of Conservation Concern potentially occurring in Study Area

| Species Common Name (Scientific Name) | Life History/Habitat |
|---|---|
| Piñon jays<br>*(Gymnorhinus cyanocephalus)* | Range the semiarid lands of the West. Piñon jays are pinyon-juniper obligates in Colorado and nest commonly at the lower elevations of pinyon-juniper woodlands, often where junipers dominate. They prefer extensive stands far from high human activity. |
| Rufous Hummingbird<br>*(selasphorus rufus)* | Habitat includes forest edges, stream sides, mountain meadows. Breeding habitat includes forest edges and clearings, and brushy second growth within the region of northern coast and mountains. Winters mostly in pine-oak woods in Mexico. Migrants occur at all elevations but more commonly in lowlands during spring, in mountain meadows during late summer and fall. |
| Golden eagle<br>*(Aquila chrysaetos)* | Bird of grasslands, shrublands, pinyon-juniper woodlands, and ponderosa pine forests, but may occur in most other habitats occasionally, especially in winter. Nests are placed on cliffs and sometimes in trees in rugged areas, and breeding birds range widely over surrounding habitats. |
| Peregrine Falcon<br>*(Falco peregrinus)* | In Colorado breed on cliffs and rock outcrops from 4,500-9,000 ft. in elevation. They most commonly choose cliffs located within pinyon-juniper and ponderosa pine zones. These falcons feed on smaller birds almost exclusively, with White-throated swifts and rock doves being among their favored prey. |
| Prairie falcons<br>*(Falco mexicanus)* | Nest in scattered locations throughout the state where they inhabit the grassland and cliff/rock habitat types. These falcons breed on cliffs and rock outcrops, and their diet during the breeding season is a mix of passerines and small mammals. |
| Gray Vireos<br>*(Vireo vicinior)* | Are a pinyon-juniper woodland obligate. Gray Vireos usually inhabit stands dominated by juniper or thin stands of pure juniper. They construct nests of dry grasses, plant fibers, stems, and hair, often camouflaging them with sagebrush leaves. |
| Black-throated gray warblers<br>*(Setophaga nigrescens)* | Fairly common summer residents in pinyon-juniper woodlands across the southwestern half of Colorado. Some surveys show these warblers to be the most frequently encountered birds in the piñon-juniper woodland. Black-throated gray warblers, in Colorado, are pinyon-juniper obligates, preferring tall, dense piñon-juniper woodlands. Virginia's warblers in Colorado nest between 5,000-9,000 ft. in elevation. They breed most abundantly in the western quarter of the state, along the eastern slope foothills, and in the upper Arkansas River drainage. |
| Virginia's warblers<br>*(Leiothlypis virginiae)* | Virginia's warblers nest in dense shrublands and on slopes of mesas, foothills, open ravines, and mountain valleys in semiarid country. They use scrubby brush, pinyon-juniper woodland with a well-developed shrubby understory, ravines covered with scrub oak and dense shrublands, especially Gambel oak. They also breed in open ponderosa pine savannahs that have a dense understory of tall shrubs. |

Sources: USFWS 2019, BLM 2017

## Table J-2. Federally Listed Species Potentially Occurring in Study Area

| Common Name (Scientific Name) | Listing Status | Associated Habitat Types | Potential to Occur (Yes/No) | Notes |
|---|---|---|---|---|
| ***Mammals*** | | | | |
| Canada Lynx<br>*(Lynx Canadensis)* | FT | Boreal forests with large woody debris. | No | No habitat present within study area. |
| North American Wolverine<br>*(Gulo gulo luscus)* | PFT | Boreal forests, tundra, and montane conifer forests. | No | No habitat present within study area. |
| ***Birds*** | | | | |
| Mexican Spotted Owl<br>*(Strix occidentalis lucida)* | FT | Steep Canyons with old growth forest in mixed conifer, pine-oak woodlands. | No | No habitat present within study area. Study area is located within species range. |

Source: USFWS 2019

FT = Federally Threatened; PFT = Proposed Federally Threatened

## Table J-3. BLM Sensitive Wildlife and Plant Species Potentially Occurring in the Study Area

| Common Name (Scientific Name) | Management Status | Associated Habitat Types | Potential to Occur (Yes/No) | Notes |
|---|---|---|---|---|
| ***Mammals*** | | | | |
| Townsend's big-eared bat<br>*(Corynorhinus townsendii pallescens)* | BLM, SC | The species breeds and forages in a variety of habitats, including lowland riparian, desert shrub, forest, grassland, and towns, from 1,770 to 6,980 ft. in elevation and roosts primarily in mines, caves, and structures in woodlands. | Yes | Potential habitat present within study area. |
| Gunnison's prairie dog<br>*(Cynomys gunnisoni)* | BLM | Grasslands, semi-desert, and montane shrublands. | No | No habitat present within study area. |
| Black-tailed prairie dog<br>*(Cynomys ludovicianus)* | BLM, SC | Grasslands. | No | No habitat present within study area. |
| Fringed myotis<br>*(Myotis thysanodes)* | BLM | The species breeds and forages in a wide variety of habitats, including lowland riparian, grassland, desert shrub, pinyon-juniper forests, and meadows, between 1,380 and 7,080 ft. in elevation. It roosts in rock crevices, mines, caves, trees, and buildings. | Yes | Potential habitat present within study area. |

| Common Name (Scientific Name) | Management Status | Associated Habitat Types | Potential to Occur (Yes/No) | Notes |
|---|---|---|---|---|
| Rocky mountain bighorn sheep<br>*(Ovis canadensis)* | BLM | The species inhabits steep, high mountain terrain. Summer habitat is primarily alpine tundra. Winter habitat is lower elevation open, grass areas and slopes, with low shrubs. | Yes | Potential habitat present within study area. |
| Swift fox<br>*(Vulpes velox)* | BLM, SC | The species inhabits short grass and mixed-grass prairies. It is closely associated with prairie dog colonies. | No | No habitat present within study area. |
| ***Birds*** | | | | |
| Northern goshawk<br>*(Accipter gentilis)* | BLM | Mixed coniferous forest and mature aspen stands with tall trees, intermediate canopy coverage for nesting, and small open areas for foraging. | No | No habitat present within study area. |
| Golden eagle<br>*(Aquila chrysaetos)* | BLM | The species breeds and forages in a variety of habitats, including large expanses of grasslands, sagebrush, agricultural lands, and tundra. It constructs a large stick nest on cliffs and in large trees and exhibits high nest fidelity. | Yes | Potential habitat present within study area. |
| Burrowing owl<br>*(Athene cunicularia)* | BLM, ST | The species breeds and forages in a wide variety of arid and semiarid environments, including grassland, desert, and shrub-steppe habitats, and agricultural areas. It generally nests in burrows excavated by small mammals, particularly prairie dogs and ground squirrels. | Yes | Potential habitat present within study area. |
| Ferruginous hawk<br>*(Buteo regalis)* | BLM, SC | The species breeds in semiarid open country, primarily grasslands, basin prairie shrublands, and badlands, typically near prairie dog colonies. It requires large tracts of relatively undisturbed rangeland for foraging habitat. | Yes | Potential habitat present within study area. |
| Western snowy plover<br>*(Charadrius alexandrinus nivosus)* | BLM, SC | The subspecies breeds and forages on alkali playas near large standing pools of shallow water. | No | No habitat present within study area. |
| Mountain plover<br>*(Charadrius montanus)* | BLM, SC | The species breeds and forages in flat, short-grass prairie habitat and fallow agricultural fields with sparse vegetation. | No | No habitat present within study area. |

| Common Name (Scientific Name) | Management Status | Associated Habitat Types | Potential to Occur (Yes/No) | Notes |
|---|---|---|---|---|
| American peregrine falcon<br>*(Falco peregrinus anatum)* | BLM, SC | The species breeds and forages in a variety of open habitats, including woodlands, forests, shrub-steppe, grasslands, marshes, and riparian habitats. It nests on cliffs and rarely on tall buildings near habitats with abundant prey. | Yes | Potential habitat present within study area. |
| Bald eagle<br>*(Haliaeetus leucocephalus)* | BLM, SC | The species breeds near large lakes and rivers, in forested habitat where adequate prey and large, old cottonwood or conifer trees are available for nesting. | No | No habitat present within study area. |
| Long-billed curlew<br>*(Numenius americanus)* | BLM, SC | The species breeds and forages in a variety of grassland habitats, including moist meadow grasslands, agricultural areas, and dry prairie uplands, usually near water. | No | No habitat present within study area. |
| White-faced ibis<br>*(Plegadis chihi)* | BLM | The species breeds in tall emergent vegetation growing as "islands", surrounded by water (at least 18 inches deep). It forages in wet hay meadows and flooded agricultural croplands, marshes, shallow ponds, lakes, and reservoirs. | No | No habitat present within study area. |
| American white pelican<br>*(Pelecanus erythrorhynchos)* | BLM, SC | The species breeds on islands in large bodies of water. It forages in marshes, lakes, and rivers. | No | No habitat present within study area. |
| Brewer's sparrow<br>*(Spizella breweri)* | BLM | The species is a sagebrush obligate. It breeds and forages in sagebrush shrublands with abundant, scattered shrubs and short grasses. | No | No suitable habitat is present within study area. |
| ***Fish*** | | | | |
| Arkansas darter<br>*(Etheostoma cragini)* | BLM, ST | Spring-fed headwaters and creeks with cool, clear, shallow water, slow current, and herbaceous aquatic vegetation such as growths of watercress or other aquatic plants; often in pools with sand, fine gravel, or organic detritus substrate; sometimes in turbid water away from springs. | No | Localized populations occur in the Arkansas River drainage in southeastern Colorado from El Paso County eat to the Kansas border (Miller 1984). |

| Common Name (Scientific Name) | Management Status | Associated Habitat Types | Potential to Occur (Yes/No) | Notes |
|---|---|---|---|---|
| ***Reptiles*** | | | | |
| Common kingsnake<br>*(Lampropeltis getula)* | BLM, SC | Generally associated with lowland river valleys and irrigated fields on the floodplain of the Arkansas River, in rural residential areas in plains grassland, near stream courses, and in other areas dominated by shortgrass prairie. | No | Colorado distribution includes southeastern Colorado east of Pueblo. |
| Massasauga<br>*(Sistrurus catenatus)* | BLM, SC | Dry plains grassland and sandhill areas; attracted to sandy soils supporting abundant rodent and lizard populations. | No | Colorado distribution includes southeastern Colorado east of Pueblo at elevations below about 5,500 ft. |
| ***Amphibians*** | | | | |
| Northern cricket frog<br>*(Acris crepitans)* | BLM, SC | This species inhabits the edges of sunny marshes, marshy ponds, and small slow-moving streams in open country. | No | Possibly extirpated, not seen in the state since 1979 (CPW 2019e). |
| Boreal toad<br>*(Anaxyrus boreas boreas)* | BLM, SE | Species non-breeding habitat consists of spruce-fir forests and upland vegetation. Breeding habitat includes low-gradient streams, marshes, beaver ponds, small lakes and reservoirs, stock ponds, wet meadows, and seeps. | No | Study area is below the documented elevation range of the species (CPW 2019e). |
| Plain's leopard frog<br>*(Rana blairi)* | BLM, SC | Streams, ponds, creek pools, reservoirs, irrigation ditches, and marshes in areas of prairie and desert grassland, farmland, and prairie canyons. | Yes | Colorado distribution includes the great plains portion of the Arkansas River drainage in southeastern Colorado (CPW 2019e). |
| Northern leopard frog<br>*(Rana pipiens)* | BLM, SC | Species occurs in marshes, beaver ponds, streams, rivers, and lakes up to 9,000 ft. in elevation. | No | Colorado distribution is nearly statewide in mountains and lowlands, but scarce or absent in most of southeastern Colorado (CPW 2019). |
| ***Plants*** | | | | |
| Rydberg's golden columbine<br>*(Aquilegia chrysantha var. rydbergii)* | BLM | Riparian areas or rocky ravines, often associated with cottonwoods or willows, often found at the base of boulders. 5,000-8,200 ft. | Yes | Potential habitat present within study area. |
| Crandall's rockcress<br>*(Arabis crandallii)* | BLM | Grows among limestone rocky areas between 8,000-10,000 ft., often associated with sagebrush shrublands or Ponderosa pine. | No | The study area is below the documented elevation range of the species. |

| Common Name (Scientific Name) | Management Status | Associated Habitat Types | Potential to Occur (Yes/No) | Notes |
|---|---|---|---|---|
| Dwarf milkweed *(Asclepias uncialis)* | BLM | Generally flat areas between 3,800-7,700 ft., often associated with shortgrass prairie, growing between bunchgrasses. | No | No suitable habitat is present within study area. |
| Brandegee's buckwheat *(Eriogonum brandegeei)* | BLM | Barren outcrops of white to grayish soils within open sagebrush and pinyon-juniper communities. 5,700-8,600 ft. | Yes | Potential habitat present within study area. |
| Colorado buckwheat *(Eriogonum coloradense)* | BLM | Found in an extremely wide range of habitats however all are of a higher elevation than the Parkdale project area. 8,700-14,000 ft. | No | The study area is below the documented elevation range of the species. |
| Gold blazingstar *(Mentzelia chrysantha)* | BLM | Often associated with barren shale or limestone hills in pinyon-juniper woodlands from 4,750-6,800 ft. Highly associated with Fremont county and the Arkansas river. Typically found on barren slopes and road cuts of limestone, shale, or alkaline clay. | Yes | Potential habitat present within study area. |
| Royal Gorge blazingstar *(Mentzelia densa)* | BLM | Occurs in open areas such as sandy washes and steep rocky slopes in pinyon-juniper woodlands and montane shrublands. Occurs almost exclusively in Fremont county between 5,400-7,700 ft. | Yes | Potential habitat present within study area. |
| Rock-loving neoparrya *(Neoparrya lithophila)* | BLM | Grows on volcanic substrates, in cracks or shelves usually with minimal talus. It is seen in moderate to steep rock outcrops, or outcrops of volcanic soils. It also occurs on sedimentary rock derived from extrusive volcanics (Dry Union Formation at Salida). The surrounding habitat is typically grasslands or pinon-juniper woodlands. | Yes | Documented occurrences are from extreme western Fremont County. |
| Few-flower ragwort *(Packera pauciflora)* | BLM | Wet meadows from 8,800-10,000 ft. Known populations in Colorado occur only in Park County. | No | The study area is below the documented elevation range of the species. |
| Degener's beardtongue *(Penstemon degeneri)* | BLM | This species is found in open pinyon-juniper woodlands between 5,900-9,500 ft. in elevation. Often found near canyon rims. | Yes | Potentially suitable habitat located within study area. |
| Pale blue-eyed grass *(Sisyrinchium pallidum)* | BLM | Species occurs in wet meadows usually where standing water is present until early July. Grows on alkaline soils between 6,300-9,700 ft. | No | No suitable habitat is present within study area. Documented occurrences are from extreme western Fremont County. |

| Common Name (Scientific Name) | Management Status | Associated Habitat Types | Potential to Occur (Yes/No) | Notes |
|---|---|---|---|---|
| Rolland's bulrush<br>*(Trichophorum pumilum)* | BLM | Moss hummocks in rich fens, 9,300-11,000 ft., only known populations in Colorado are in Park county. | No | No suitable habitat is present within study area. |

Source: BLM 2019a

BLM = Bureau of Land Management designated sensitive species; SC = State Species of Special Concern (not a statutory category); ST = State Threatened; SE = State Endangered

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# *Appendix K*

## Interim Hydrologic Assessment

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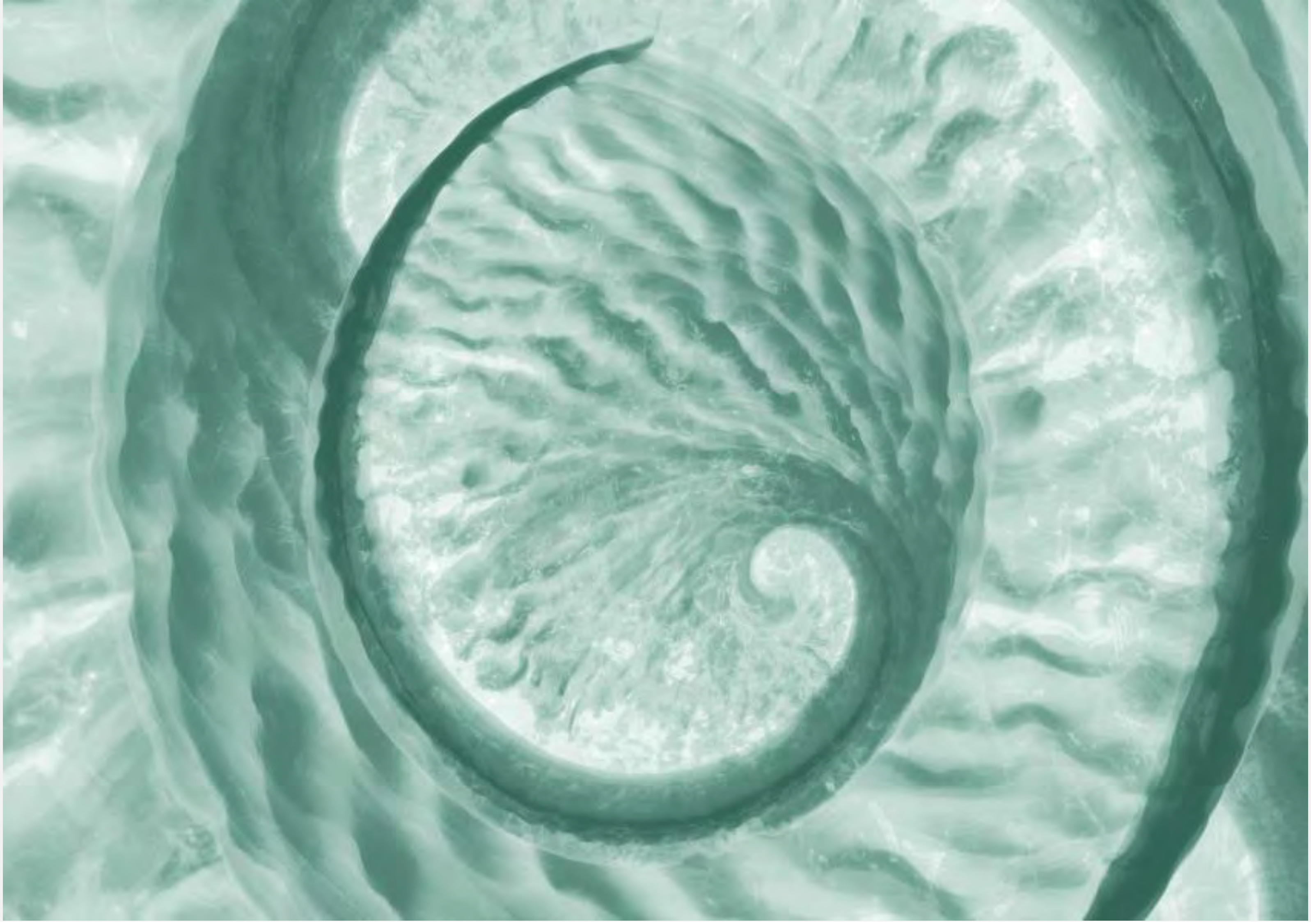

# Interim Hydrogeologic Assessment

Martin Marietta Materials

Parkdale Quarry Expansion Area

20 August 2019

Project No.: 0488586

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ERM

## Signature Page

20 August 2019

# Interim Hydrogeologic Assessment

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## Acronyms and Abbreviations

| | |
|---|---|
| amsl | Above mean sea level |
| bgs | Below ground surface |
| BLM | Bureau of Land Management |
| cm/sec | Centimeters per second |
| DO | Dissolved oxygen |
| DWR | Division of Water Resources |
| EC | Electric conductivity |
| ERM | Environmental Resources Management |
| feet/day | Feet per day |
| gpm | Gallons per minute |
| K | Mean hydraulic conductivity |
| mg/L | Milligrams per liter |
| ug/L | Micrograms per liter |
| NEPA | National Environmental Policy Act |
| ORP | Oxidation reduction potential |
| pCi/L | Picocuries per liter |
| TDS | Total dissolved solids |

# INTRODUCTION

Environmental Resources Management (ERM) is pleased to provide this report summarizing an interim hydrogeologic assessment at the area proposed for expansion of the Parkdale Quarry (hereinafter “Site”) onto Bureau of Land Management (BLM) land near Canon City, Colorado (hereinafter “Project”). ERM understands the purpose of the investigation is to perform a scoping-level analysis to evaluate if the expanded quarry could affect the quantity and quality of the underlying groundwater system, and most notably, if water levels could potentially be lowered in existing private water wells located on properties near the Site. Additionally, it is understood that hydrogeologic monitoring and assessment may be used to support Martin Marietta’s overall permitting process for the Project, including the National Environmental Policy Act (NEPA) review process.

# 1. BACKGROUND

## 1.1 Parkdale Quarry Expansion

Martin Marietta is pursuing permits and approvals to expand the Site onto BLM lands located generally north of the current mining operations, as shown on Figure 1. As part of the expansion area investigation, Martin Marietta drilled nine 3.75-inch exploratory boreholes to a depth of 250 feet below ground surface (bgs) and completed three of the borings as 2-inch monitoring wells with screened intervals from approximately 20 to 250 feet bgs (Figure 1). These borings generally encountered small amounts up to 5 feet of decomposed granite sands, small amounts up to 15 feet of weathered and partially weathered granite, and competent fractured granite to the bottom of the borehole. At some locations on Cactus Mountain, bedrock outcrops at the surface.

## 1.2 Geologic Setting

The Site is located in the northern extent of the northwest trending Wet Mountains, a sub-range of the Sangre de Cristo Mountains, as part of the Southern Rocky Mountains physiographic region. The gneiss, schist, and granite of the Wet Mountains were exposed during the Wet Mountain uplift as part of the Laramide orogeny (Christman et. al. 1954).

Locally, the Precambrian granite of Cactus Mountain is in fault contact with the Jurassic and Cretaceous sedimentary rocks as part of the larger northwest trending subvertical Ilse fault and the Parkdale fault (Wobus et. al. 1979). The sedimentary rocks, including sequences of limestone, sandstone, and shale are found immediately south of the proposed excavation and north-northeast of Cactus Mountain (Figure 2). Historical quarry operation excavated coarse alluvium adjacent to the Arkansas River. Current quarry operations excavate granite on Martin Marietta owned property. The proposed quarry expansion onto BLM land would continue to excavate granite to be crushed for an aggregate end product.

The Tallahassee Creek Mining District, which produced uranium, is located approximately three miles west of the area (Hon, 1984). The Tallahassee Creek Mining District area is drained by Tallahassee Creek.

## 1.3 Hydrogeologic Settings

The Site is located at the lower end of the Currant Creek and Tallahassee Creek watersheds, near the confluence of Tallahassee Creek with the Arkansas River (Figure 1). Groundwater in the site area is present in four hydrogeologic units: alluvium adjacent to Currant Creek, Tallahassee Creek, and the Arkansas River; sedimentary rocks; decomposed and/or weathered granite; and competent fractured granite. There are mapped faults within the granite body and fault contacts between the granite and sedimentary rocks (Figure 2).

## 2. DATA COMPILATION AND REVIEW

ERM conducted a desktop review of relevant publicly available data. The Colorado Division of Water Resources (DWR) well permit database identified wells of other ownership within the project vicinity (Figure 3). Using this database, ERM determined distances from the proposed quarry excavation to other groundwater users for use in the analysis.

Available DWR Well Construction and Test Reports for wells immediately to the north and northeast of Cactus Mountain show that all wells are drilled into Cretaceous sedimentary rocks. However, DWR locations for select wells are mapped as granite (see Figure 4, noted as potentially mislocated). If the mapped granite and sedimentary rock contact is accurate, this discrepancy may indicate that some available DWR wells were likely mislocated by the permit applicant or driller, as shown in Figure 4.

The DWR database returned 139 wells within a four mile radius of the proposed quarry (Figure 3) and are summarized in Table 1. A complete database will be provided electronically to Martin Marietta.

**Table 1: Primary Water Use of CDWR Wells within 4 Miles of Proposed Quarry**

| Primary Water Use | Count |
|---|---:|
| Domestic | 120 |
| Household use only | 8 |
| Stock | 6 |
| Commercial | 2 |
| Irrigation | 2 |
| Other | 1 |
| **Total** | **139** |

# 3. FIELD INVESTIGATION

During the 4th quarter of 2018 and the 2nd quarter of 2019, ERM conducted two field investigations at monitoring wells 1, 3, and 10, as discussed below.

## 3.1 4th Quarter (December) 2018

ERM conducted the initial field investigation from December 10 through 12, 2018, and included the following activities:

- Conducting groundwater sampling via pumping with a Grundfos Redi-Flo 2 submersible pump capable of lifting water from 300 feet.
- Monitoring water levels in the pumping well before, during, and/or after purging using an In-Situ Level Troll (Model 700) 100 (pounds per square inch) psi vented pressure transducer.
- Monitoring field water quality parameters throughout the duration of pumping using a YSI flow through cell, including temperature, pH, electric conductivity (EC), dissolved oxygen (DO), and oxidation reduction potential (ORP). Field forms are provided as Appendix A.
- Conducting water quality sampling for common metals, major ions, and radionuclides after water quality parameter stabilization.

## 3.2 2nd Quarter (May) 2019

ERM conducted the second field investigation from May 13 through 14, 2019, and performed activities that were similar to those described above for the initial field investigation, but did not include water level monitoring during pumping and recovery (i.e., no pumping test analysis).

# 4. DATA ANALYSIS

Using the above-mentioned field collected data, ERM completed analysis respective of laboratory analytical results and hydraulic conductivity estimates based on recorded water levels during well purging for water quality sampling.

## 4.1 Water Quality

ERM analyzed water quality samples for field parameters, common metals, major ions, and radionuclides, and then tabulated and presented the results in the laboratory analytical reports provided as Appendix E. Results show pH ranges from 6.64 - 7.71, and total dissolved solids (TDS) ranges from 318 - 437 milligrams per liter (mg/L). While not required for compliance purposes, the analytical results were compared to drinking water standards for informational purposes only. The December 2018 sample from Well 10 was reported to contain 38.2 micrograms per liter (ug/L) of dissolved uranium, in excess of the 30 ug/L drinking water standard. However, uranium in excess of the drinking water standard was not measured in the May, 2019 samples. The December 2018 samples from wells 1, 3, and 10 were reported to contain 19, 47, and 120 picocuries per liter (pCi/L) of gross alpha particles respectively, in excess of the 15 pCi/L drinking water standard. The May, 2019 samples from wells 1, 3, and 10 were reported to contain 18, 47, and 25 pCi/L of gross alpha particles respectively. The December 2018 sample from well 10 was reported to contain 7.5 pCi/L of radium 226/228, in excess of the 5 pCi/L drinking water standard. The May, 2019 samples from wells 3 and 10 were reported to contain 12 and 7.5 pCi/L of radium 226/228.

Hydrochemical facies, or water types, are located within the magnesium bicarbonate and mixed magnesium bicarbonate/calcium chloride portion of the piper diagram presented as part of Appendix B.

## 4.2 Hydraulic Properties

Pumping and water level data collected during the first investigation (December 2018) were used to estimate granite bulk hydraulic conductivity via Wells 1, 3, and 10 using high-resolution monitored water levels to calculate drawdown information during pumping and/or recovery post-pumping via pressure transducer. Hydraulic responses were analyzed for the recovery of Well 1, recovery of Well 3, and variable flow rate pumping of Well 10. Hydraulic responses were analyzed using analytical techniques, incorporating superposition, to account for variable flow rate pumping and zero flow rate during recovery. Pumping test results are tabulated in Table 2.

The pumping rate and water level information collected during the 4th quarter 2018, is presented in Appendix C.

**Table 2: Results of Pumping Tests**

| Monitoring Well | Well Total Depth (ft) | Static Depth-to-Water (ft) | Saturated Thickness (ft) | T ($ft^2$/day) | K (ft/day) | K (cm/sec) |
|---|---|---|---|---|---|---|
| Well 1 | 239 | 104.13 | 134.9 | 0.26 | 0.0019 | 6.8E-07 |
| Well 3 | 249 | 47.55 | 201.4 | 0.63 | 0.0031 | 1.1E-06 |
| Well 10 | 251 | 9.76 | 241.2 | 1.57 | 0.0065 | 2.3E-06 |

*Notes:*
*ft: feet*
*$ft^2$/day: feet squared per day*
*ft/day: feet per day*
*cm/sec: centimeters per second*
*T = transmissivity of saturated well completion interval (from static water level to bottom of well)*
*K = average hydraulic conductivity of granite within the well completion interval*

The reported mean hydraulic conductivity (K) from hydraulically testing the three monitoring wells was 0.0039 feet per day (feet/day) (1.36 x $10^{-6}$ centimeters per second [cm/sec]), which is taken as the best-estimate bulk granite hydraulic conductivity. Appendix A of this report tabulates pumping test results, expands upon well details respective of water levels over-time at each monitoring well during and after testing, and details hydraulic analysis used at each monitoring well.

# 5. SIMULATED CURRENT CONDITIONS

ERM performed a scoping-level analysis of current conditions from the desktop compilation and field data gathered. Potential groundwater through-flow in the proposed quarry area was simulated using a modification of a one-dimensional Darcy equation for groundwater flow in a vertical cross section. The analysis considered variable saturated thickness, aerially distributed recharge, and a sloping no-flow boundary at the base of “permeable” granite. The cross section starts at the confluence of Currant Creek and Tallahassee Creek, and extends 13,500 feet northeast across Cactus Mountain to Highway 9, as shown in Appendix D. The analysis uses a steady-state solution with an assumed fixed hydraulic head of 5,840 feet above mean sea level (amsl) at the southeast end of the section (confluence of the two streams), which conforms to the elevation of the stream channels. The best-estimate mean hydraulic conductivity from pumping tests (0.0039 feet/day, 1.36 x $10^{-6}$ cm/sec) was assigned to the granite above the no-flow boundary. The solution was calibrated by adjusting recharge until computed hydraulic heads matched Wells 3 and 10 measured water levels, which lie along the cross section, as well as potentiometric head at Highway 9, approximately 100 feet bgs, consistent with measured water levels in the area (as shown on the cross section figure in Appendix D). The calibrated recharge to the granite was found to be 0.16 inches per year. Groundwater flow is predicted to be to the south or southwest, in the direction of the current quarry, on the southwest side of Cactus Mountain and to the north or northeast on the northeast side of Cactus Mountain. Appendix D provides scoping-level analysis details including assumptions and solution method approach. The ability of this analysis to match measured water levels provides evidence that the assigned granite hydraulic conductivity is reasonable for the scale of the proposed quarry and surrounding area.

# 6. SCOPING-LEVEL QUARRY EXCAVATION EFFECTS TO GROUNDWATER

## 6.1 Water Quality

Respective of Section 4.1, analytical results indicated drinking water exceedance for dissolved uranium, gross alpha, gross beta, and radium 226/228 in some of the samples analyzed. Radionuclides are generally found as trace elements in most granitic rocks, such as the Precambrian granite housing site groundwater, and are not unusual for the region. The general decline in these analytical parameters could be due to further well development as a result of additional pumping during the sampling event. All other common ions and metals are within drinking water quality standards. Based on known rock properties for the area within the proposed quarry expansion area, it is not anticipated that the project will have a negative impact on groundwater quality in the granite or surrounding aquifers where wells of other ownership are completed. Additionally, groundwater discharges to surface waters are not anticipated to change or adversely affect current surface water quality.

## 6.2 Drawdown Analysis

ERM performed a scoping-level analysis of the change in water levels due to the proposed quarry excavation using two transient analytical solutions: one for southwest linear flow towards the quarry highwall and one for radial flow to a semicircle representing the northeast portion of the quarry. The analyses were completed based on current conditions and did not take into account future mining operations currently permitted at the existing Parkdale Quarry and the potential impacts to groundwater that could result from those activities. The details of these analytical solutions are described in Appendix E. The best-estimate mean hydraulic conductivity from pumping tests was used along with a storage coefficient of 0.01, considered reasonable respective of fractured granite specific yield. Both solutions assumed the following:

- The quarry is instantaneously excavated to full depth at time zero.
- Hydraulic drawdown (groundwater level lowering) at the quarry wall is 300 feet.
- Thickness of permeable fractured bedrock is 500 feet.
- Groundwater flow towards the quarry is strictly horizontal.

Both analyses gave similar hydraulic drawdown results at Highway 9:

- For the first 20 years of quarry operation, the computed hydraulic drawdown is negligible.
- After 40 years of mine operation, drawdown is simulated at about 2 feet.
- At 80 years of mine operation, drawdown is simulated to be 16 feet for the linear flow solution and 10 feet for the radial.
- The computed drawdown contours at 80 years for the linear and radial flow models are presented in Figure 5 and Figure 6. These contours are estimated from the cross sectional solution methods. The saturated water column thickness (total depth of the well minus the static depth to water at time of drilling) is presented on these figures to give context to the wells potential to tolerate possible regional drawdown.

Computed drawdowns can be considered over-estimates, and thus conservative in nature. For example, both analytical solutions assume that low hydraulic conductivity granite extends to Highway 9 and beyond, while it is known that wells in this area are completed in higher hydraulic conductivity sedimentary rock. Higher hydraulic conductivity at Highway 9 would have a muting effect on drawdown effects associated with the quarry. Additionally, to the south, the perennial Arkansas River acts as a fixed head boundary (holding groundwater levels near constant elevation). Therefore, the proposed quarry would not likely affect groundwater levels nearby or southward towards the River.

## 6.3 Quarry Inflows

Both analytical solutions produced similar estimates of groundwater inflow rates to the quarry. Both solutions predict relatively high inflow rates during the first several years of operations, but these small-time estimates are a consequence of assuming instantaneous excavation of the final quarry. In reality, the quarry would be excavated gradually over time, so the actual early inflow rates are likely to be low (approximately less than 25 gallons per minute [gpm]). With time, inflow rates are predicted to decrease to less than 15 gpm after 10 years. These low inflow rates are a consequence of the low hydraulic conductivity granite and are inconsequential to a freely draining mine quarry. The predicted inflow rates are consistent with observations of the current quarry faces by Martin Marietta, which total approximately 270 feet in vertical height, where little or no water is observed draining out except after precipitation events. It is likely that water volumes in the quarry from rainfall, storm runoff, and snowmelt will be much larger than groundwater inflows.

# 7. DISCUSSION

The scoping-level calculations presented in this memorandum should not be considered numerical groundwater modeling results. They are intended to provide a general overview of potential groundwater effects resulting from the proposed quarry excavation. The conservative results provide evidence that groundwater effects at existing wells, while not negligible, will not likely result in abandonment of wells over many decades of mine operation. No significant impacts to surface water quality are anticipated.

Groundwater inflows to the quarry will likely not be of operational consequence when compared to larger water volumes resulting from rainfall, storm runoff, and snow melt. Based on the aquifer characterization criteria presented by Bear, (1972) the granite would be rated as a “poor” aquifer and the relative permeability would be described as “semi-pervious to impervious.” Conceptually, precipitation that does not immediately runoff or evapotranspirate is expected to infiltrate into decomposed and weathered granite (0-20 feet thickness), which likely has a significantly higher hydraulic conductivity than the competent granite. This may lead to shallow perched water that could flow downslope towards the quarry highwall. It is possible that perched groundwater may enter the quarry via spring lines along the top of the highwall. ERM’s evaluation of this process was not considered in the work performed herein, but could be the subject of an additional analysis.

Additional water quality and hydraulic analysis and any resulting recommendations will follow with the conclusion of the proposed additional field events. Proposed future investigation work is planned for the 3rd and 4th quarters of 2019 and the 1st quarter of 2020, where ERM will collect water quality samples from each of the three monitoring wells to analyze for common metals, major ions, and radionuclides, as was done previously. Water levels during pumping and/or recovery will be recorded for comparison and verification to 4th quarter 2018 results. Any additional work will be coordinated with Martin Marietta.

# 8. REFERENCES

Bear, Jacob.1972. *Dynamics of Fluids in Porous Media*. Dover Publications.

Christman, R. A., M. R. Brock, R. C. Pearson, and Q. D. Singwald. 1954. *Wet Mountains, Colorado, Thorium Investigations 1952-1954*. United States Department of the Interior Geologic Survey. Trace Element Investigation Report 354.

Hon, Ken. 1984. *Geology of Volcanogenic Uranium Deposits within the Tallahassee Creek Conglomerate, Tallahassee Creek Uranium District, Colorado.* United States Department of the Interior Geologic Survey. Open-File Report Report 84-219.

Wobus, Reinhard A., Rudy C. Epis, and Glen R. Scot. 1979. *Geologic Map of the Cover Mountain Quadrangle, Premont, Park, and Teller Counties, Colorado*.

## FIGURES

FILE: Q:\Denver\Projects\0488586 Martin Marietta Materials, Inc. Quarry Expans.BM\01_GIS\MXD\WorkingFigures\Fig 1 Site_2.mxd, REVISED: 06/28/2019 , SCALE: 1:12,500 when printed at 11x17

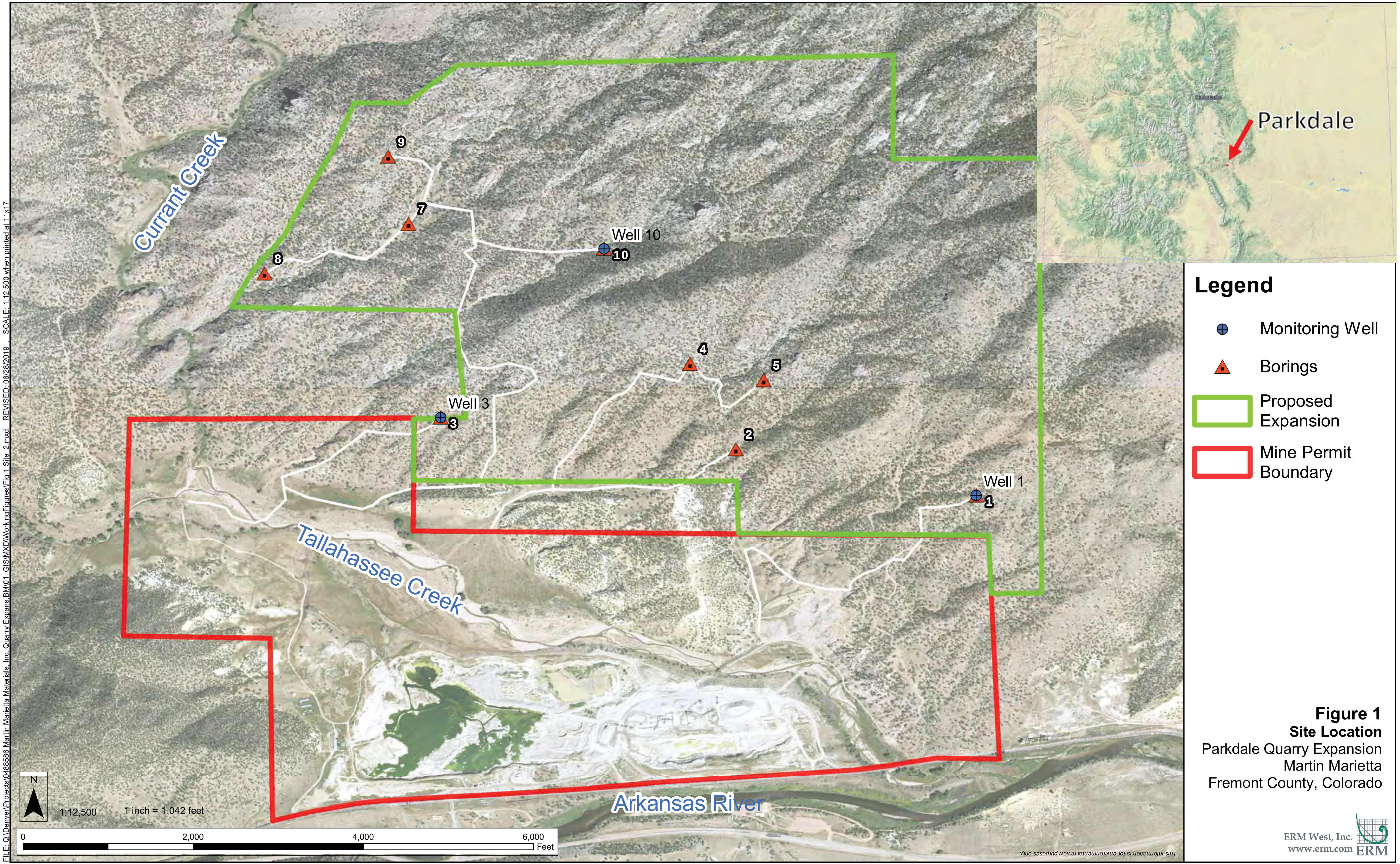


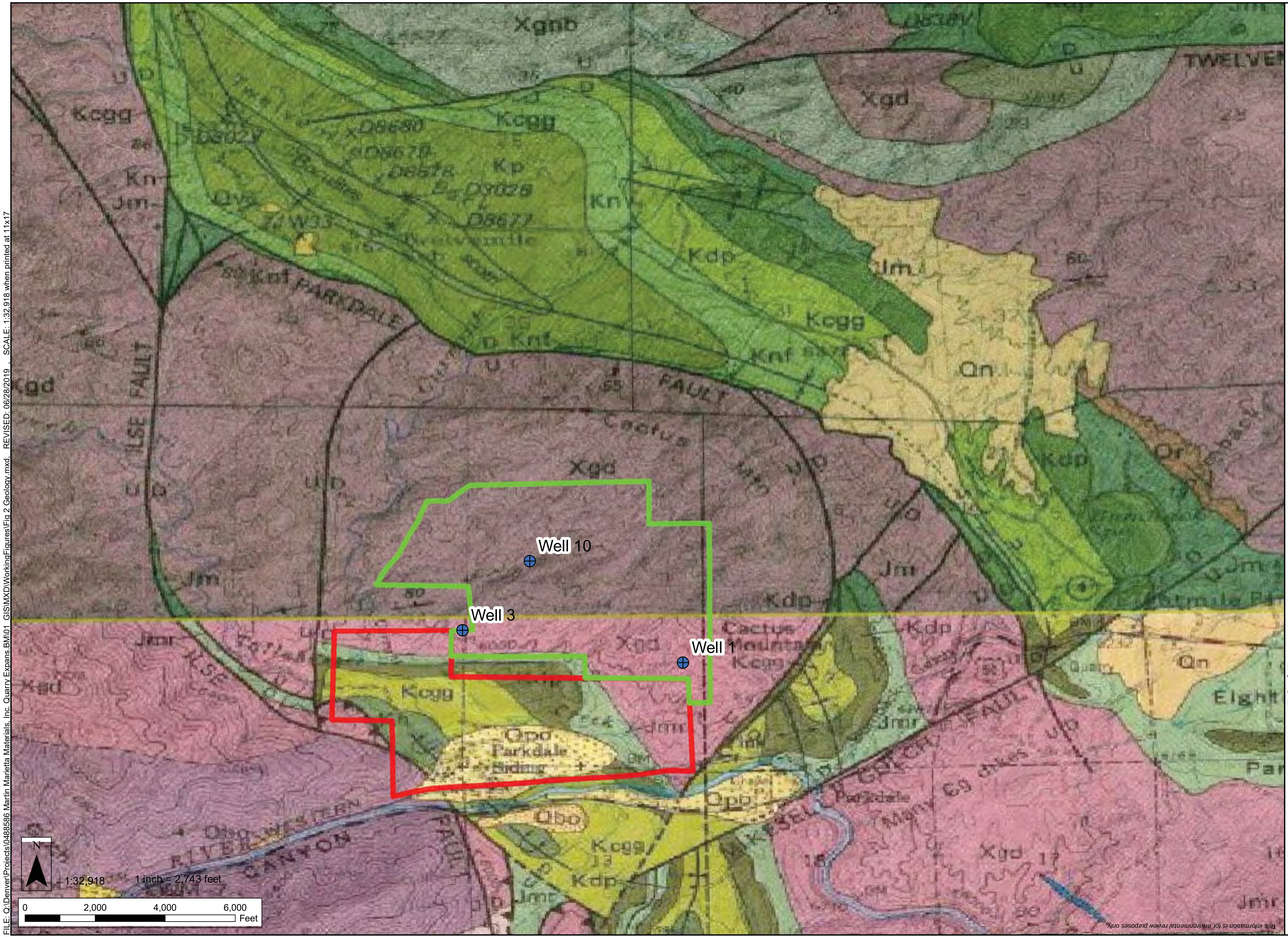
**Figure 1**
**Site Location**
Parkdale Quarry Expansion
Martin Marietta
Fremont County, Colorado

ERM West, Inc.
www.erm.com

This information is for environmental review purposes only.

Source: Esri - World Topographic Map

FILE: Q:\Denver\Projects\0488586 Martin Marietta Materials, Inc. Quarry Expans.BMI01 GIS\MXD\WorkingFigures\Fig 2 Geology.mxd, REVISED: 06/28/2019, SCALE: 1:32,918 when printed at 11x17



Source: Esri - World Topographic Map

## Legend

🟥 Mine Permit Boundary

🟩 Proposed Expansion

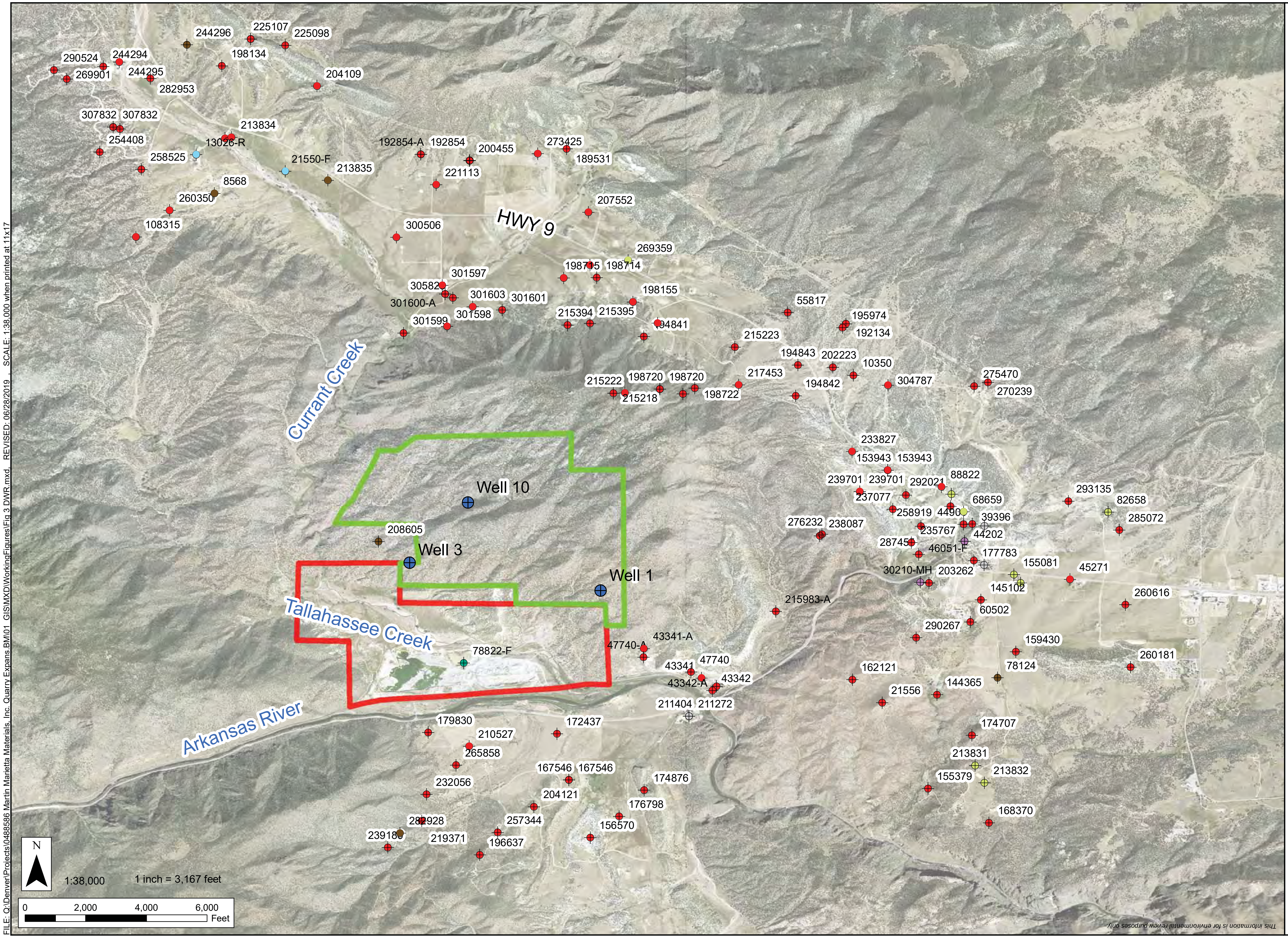
⊕ Monitoring Well

Notes:
Wobus et. al. 1979.
Geologic Map of Cover Mountain Quadrangle, Premont, Park, and Teller Counties, Colorado

**Figure 2**
**Geologic Map**
Parkdale Quarry Expansion
Martin Marietta
Fremont County, Colorado

ERM West, Inc.
www.erm.com

FILE: Q:\Denver\Projects\0488586 Martin Marietta Materials, Inc. Quarry Expans.BM\01 GIS\MXD\WorkingFigures\Fig 3 DWR.mxd, REVISED: 06/28/2019 , SCALE: 1:38,000 when printed at 11x17



Source: Esri - World Topographic Map

## Legend

🟥 Mine Permit Boundary

🟩 Proposed Expansion

⊕ Monitoring Well

### DWR

### Primary Use

⊕ Commercial

⊕ Domestic

⊕ Household Use

⊕ Irrigation

⊕ Monitoring

⊕ Other

⊕ Stock

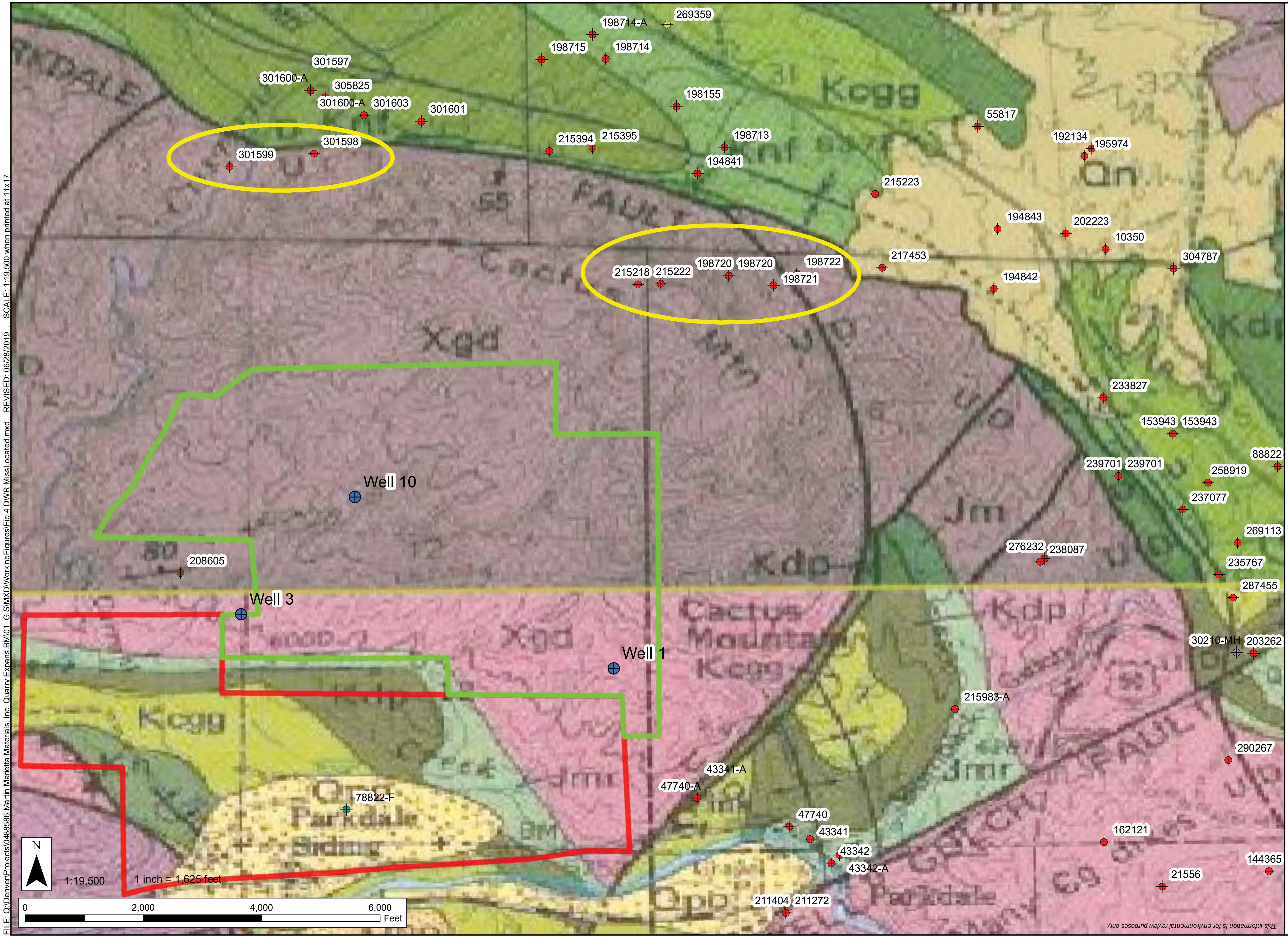
Notes:
Numbers are DWR Permit Numbers.

## Figure 3

**DWR Well Database**
Parkdale Quarry Expansion
Martin Marietta
Fremont County, Colorado

ERM West, Inc.
www.erm.com
ERM

FILE: Q:\Denver\Projects\0488586 Martin Marietta Materials, Inc. Quarry Expans.BM01 GIS\MXD\WorkingFigures\Fig 4 DWR MissLocated.mxd, REVISED: 06/28/2019, SCALE: 1:19,500 when printed at 11x17



Source: Esri - World Topographic Map

## Legend

🟥 Mine Permit Boundary

🟩 Proposed Expansion

🟨 Possibly Mislocated

⊕ Monitoring Well

## DWR

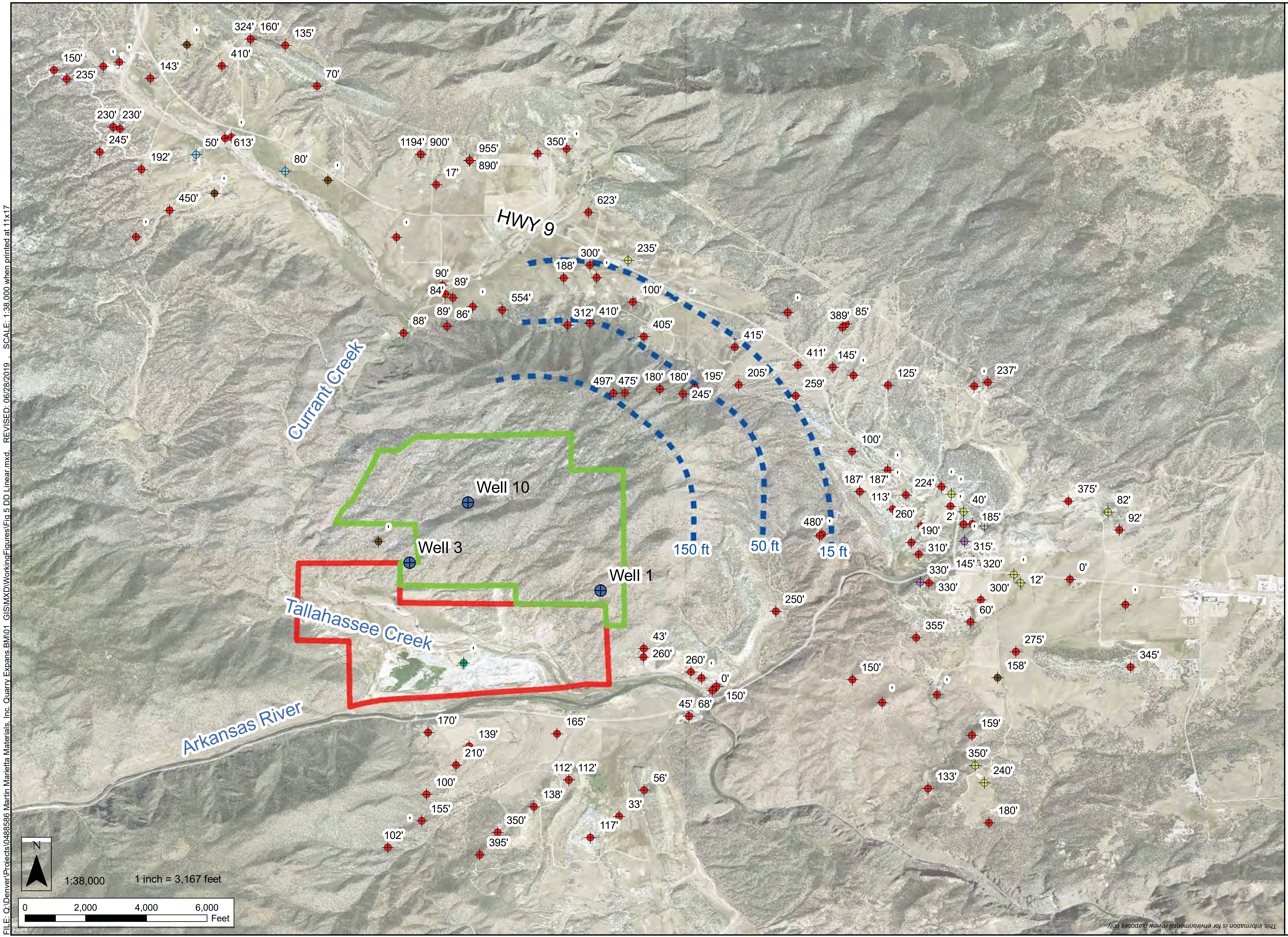
### Primary Use

- ✛ Commercial
- ✛ Domestic
- ✛ Household Use
- ✛ Irrigation
- ✛ Monitoring
- ✛ Other
- ✛ Stock

Notes:
Numbers are DWR Permit Numbers.

**Figure 4**
**DWR Mislocated Wells**
Parkdale Quarry Expansion
Martin Marietta
Fremont County, Colorado

ERM West, Inc.
www.erm.com



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FILE: Q:\Denver\Projects\0488586 Martin Marietta Materials, Inc. Quarry Expans.BMI01_GIS\MXD\WorkingFigures\Fig 5 DD Linear.mxd    REVISED: 06/28/2019    SCALE: 1:38,000 when printed at 11x17

# Legend

## DWR

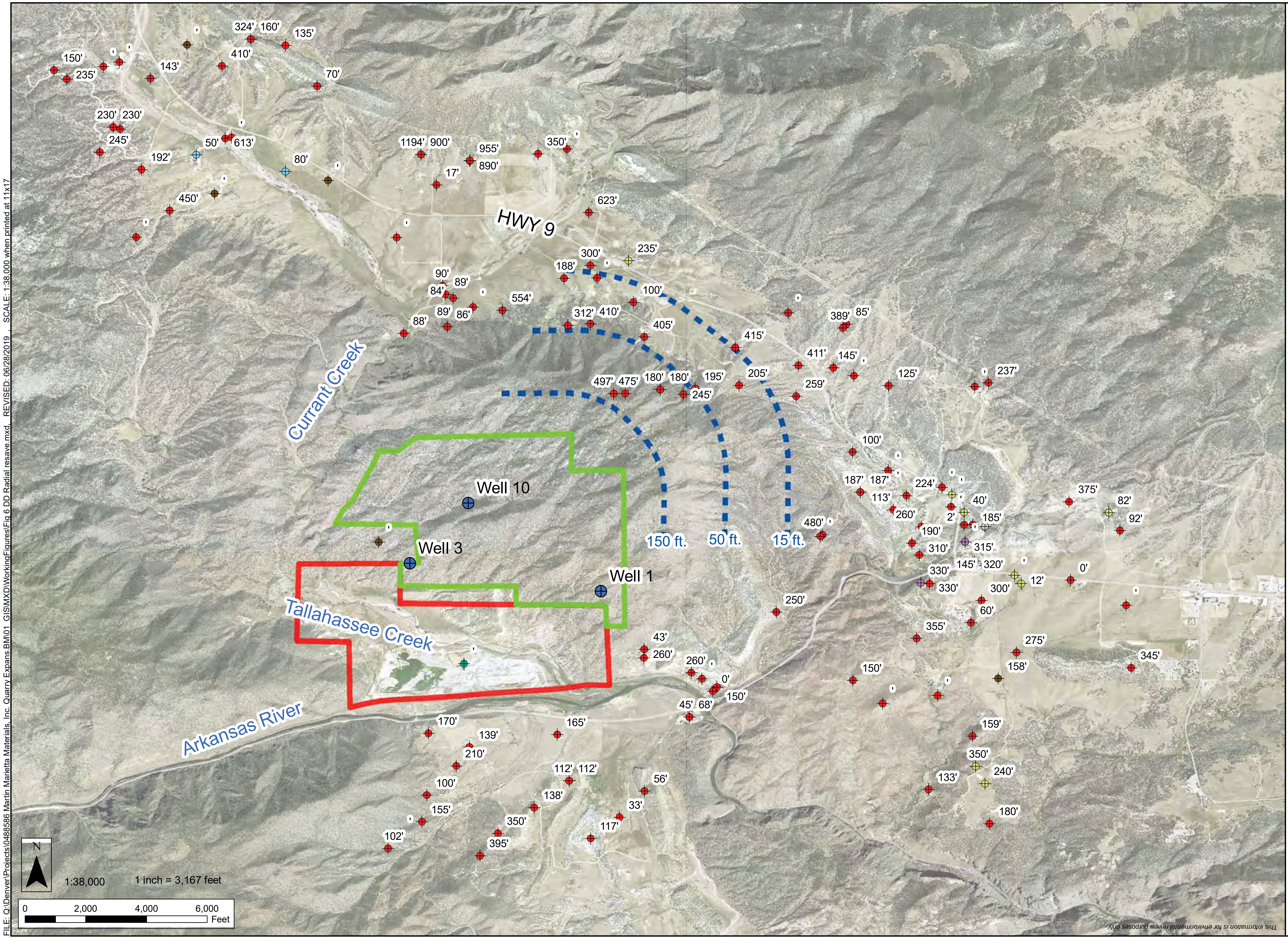
### Primary Use

- ⊕ Commercial
- ⊕ Domestic
- ⊕ Household Use
- ⊕ Irrigation
- ⊕ Monitoring
- ⊕ Other
- ⊕ Stock
- ⊕ Monitoring Well
- ▭ Proposed Expansion
- ▭ Mine Permit Boundary
- ▪ ▪ ▪ Linear Flow Model Calculated Drawdown at 80 Years

Notes:
Numbers are DWR saturated water column (ft.)

**Figure 5**
**Linear Flow Drawdown**
Parkdale Quarry Expansion
Martin Marietta
Fremont County, Colorado

ERM West, Inc.
www.erm.com



Source: Esri - World Topographic Map

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## Legend

## DWR

### Primary Use

- ⊕ Commercial
- ⊕ Domestic
- ⊕ Household Use
- ⊕ Irrigation
- ⊕ Monitoring
- ⊕ Other
- ⊕ Stock
- ⊕ Monitoring Well
- 🟩 Proposed Expansion
- 🟥 Mine Permit Boundary
- ┅ Radial Flow Calculated Drawdown at 80 Years

Notes:
Numbers are DWR saturated water column (ft.)

**Figure 6**
**Radial Flow Drawdown**
Parkdale Quarry Expansion
Martin Marietta
Fremont County, Colorado

ERM West, Inc.
www.erm.com

# APPENDIX A FIELD WATER QUALITY FORMS

Project Parkdale Quarry

Well Name Well 1

Location Cañon City, CO

Sample ID

Purpose

| Date | Time | Temperature | pH | EC | DO | ORP | Notes |
|---|---|---|---|---|---|---|---|
| | | [unit] °C | | [unit] μS/cm | [unit] mg/L | [unit] | Vol |
| 12/11/18 | 12:14 | 13.57 | 6.42 | 622 | 7.32 | 52.2 | 1 gallon, Cloudy |
| | 12:20 | 14.00 | 6.93 | 622 | 6.11 | 75.0 | 2.4 gal, Cloudy |
| | 12:26 | 13.91 | 7.42 | 624 | 6.09 | 58.8 | 3.3 gal, Cloudy |
| | 12:33 | 13.74 | 7.19 | 616 | 5.93 | 78.5 | 4.5 gal, Cloudy |
| | 12:40 | 13.84 | 7.51 | 619 | 6.01 | 74.8 | 5.5 gal, Cloudy |
| | 13:10 | 13.55 | 7.39 | 617 | 6.24 | 93.5 | 9.2 gal, Cloudy |
| | 13:49 | 12.67 | 7.41 | 627 | 7.10 | 105.3 | 13.8 gal, Sl. Cloudy |
| | 1358 | 13.45 | 7.51 | 616 | 5.87 | 102.0 | 14 gal |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

# Well Development / Purge Form

Project Parkdale Quarry
Project No.
Location
Date 12/11/18
Well Number Well 1
Method Redi Flo 3
Field Personnel PM & ZW
Setup time: 09:45

Total Depth
Depth to Water (DTW)
Water Column (ft. h.)
Casing Volume (gal) (2" = 0.16h, 4" = 0.66h) 3 vols =
Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h)
Total Gallons Removed
Sample Number & Time
Depth Ind. S/N
Weather

| Time | Duration (Minutes) | | | Volume (gallons) | Temp (°C) | DO (mg/L) | Spec. Cond. (µs/ms) | pH | ORP/ REDOX (ReL. | Turbidity (NTU) | DTW (ft btoc) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surge | Pump | Bail | | | | | | | | | |
| 10:12 | | 0 | | 0 | | | | | | | | [114.39' static |
| 11:28 | | | | 1 | 1468 | 4.37 | 587 | 7.71 | 127.0 | 743 | — | @ 09:20] |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | Original Field Form |
| | | | | | | | | | | | | blew in the wind |
| | | | | | | | | | | | | & not recovered. |
| | | | | | | | | | | | | This was the final |
| | | | | | | | | | | | | Field parameters |
| | | | | | | | | | | | | after staballization |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

**Sample Analytes:** VOCs (8260)
Semi-Volatiles (8270)
Dissolved Fe and Mn (6020) (lab filtered)
Total Alkalinity as $CaCO_3$ (SM 2320B)
Sulfate, Nitrite, Nitrate, and Chloride (EPA 300.0)
Sulfide (SM 4500S2)
Ferric and Ferrous Iron (SM3500 Fe; Hach 8146)
Dissolved Methane, Ethane, and Ethene (RSK175)

**Ferrous Iron (field test) =**_______ mg/L

1 of 4

# Well Development / Purge Form

| | | | | |
|---|---|---|---|---|
| Project | Parkdale Quarry | Total Depth | 249.0 | Depth Ind. S/N |
| Project No. | 0488586 | Depth to Water (DTW) | 47.55 | Weather |
| Location | Canon City, CO | Water Column (ft. h.) | | |
| Date | 12/11/18 | Casing Volume (gal) (2" = 0.16h, 4" = 0.66h) | | 3 vols = |
| Well Number | Well 3 | Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h) | | |
| Method | Red. Flo 2 Pump | Total Gallons Removed | | |
| Field Personnel | RM & ZW | Sample Number & Time | | |
| Setup time: | 14:00 | | | |

| Time | Duration (Minutes) | | | Volume (gallons) | Temp (°C) | DO (mg/L) | Spec. Cond. (µs/ms) | pH | ORP/ REDOX (ReL. | Turbidity (NTU) | DTW (ft btoc) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surge | Pump | Bail | | | | | | | | | |
| | | | | | | | | | | | | |
| 14:45:15 | | | | 1.0 | 14.50 | 1.81 | 516 | 6.19 | 125.7 | Sl. Cloudy | — | |
| 14:46:50 | | | | 2.0 | — | — | — | — | — | — | | |
| 14:48:00 | | | | 3.0 | 14.72 | 0.50 | 497 | 6.72 | 106.2 | Cloudy | — | |
| 14:49:20 | | | | 4.0 | — | — | — | — | — | — | — | ↑ Pump rate |
| 14:50:47 | | | | 5.0 | 14:88 | 0.53 | 480 | 6.97 | 99.8 | Sl. Cloudy | — | |
| 14:52:13 | | | | 6.0 | — | — | — | — | — | — | — | ↑ Pump rate |
| 14:53:37 | | | | 7.0 | 15:01 | 0.61 | 475 | 7.12 | 97.0 | Sl. Cloudy | — | |
| 14:54:53 | | | | 8.0 | — | — | — | — | — | — | — | ↑ Pump rate (~~125 Hz~~) |
| 14:55:50 | | | | 9.0 | 1518 | 0.65 | 475 | 7.21 | 94.0 | | | |
| 14:56:53 | | | | 10.0 | — | — | — | — | — | — | — | |
| 14:58:06 | | | | 11.0 | 15.25 | 0.66 | 476 | 7.26 | 94.7 | | | ↑ Pump rate (250 Hz) |
| 14:58:08 | | | | 12.0 | — | — | — | — | — | — | — | |
| 15:00:06 | | | | 13.0 | — | — | — | — | — | — | — | |

**Sample Analytes:** VOCs (8260)
Semi-Volatiles (8270)
Dissolved Fe and Mn (6020) (lab filtered)
Total Alkalinity as $CaCO_3$ (SM 2320B)
Sulfate, Nitrite, Nitrate, and Chloride (EPA 300.0)
Sulfide (SM 4500S2)
Ferric and Ferrous Iron (SM3500 Fe; Hach 8146)
Dissolved Methane, Ethane, and Ethene (RSK175)

**Ferrous Iron (field test)** =_______ mg/L

2 of 4

# Well Development / Purge Form

Project
Project No.
Location
Date
Well Number
Method
Field Personnel
Setup time:

Total Depth
Depth to Water (DTW)
Water Column (ft. h.)
Casing Volume (gal) (2" = 0.16h, 4" = 0.66h) 3 vols =
Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h)
Total Gallons Removed
Sample Number & Time

Depth Ind. S/N
Weather

| Time | Duration (Minutes) | | | Volume (gallons) | Temp (°C) | DO (mg/L) | Spec. Cond. (µs/ms) | pH | ORP/ REDOX (ReL. | Turbidity (NTU) | DTW (ft btoc) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surge | Pump | Bail | | | | | | | | | |
| 15:01:10 | | | | 14.0 | 15.33 | 0.68 | 475 | 7.36 | 92.7 | — | — | |
| 15:02:22 | | | | 15.0 | f— | — | — | — | — | — | — | ↑ pump rate |
| 15:03:34 | | | | 16.0 | — | — | — | — | — | — | — | |
| 15:04:40 | | | | 17.0 | 15.45 | 0.71 | 475 | 7.42 | 92.1 | — | — | |
| 15:05:54 | | | | 18.0 | — | — | — | — | — | — | — | ↑ pump rate |
| 15:07:02 | | | | 19.0 | 15.52 | 0.72 | 475 | 7.45 | 92.3 | 550 | — | |
| 15:08:13 | | | | 20.0 | — | — | — | — | — | — | — | |
| 15:09:16 | | | | 21.0 | 15.58 | 0.76 | 475 | 7.50 | 90.6 | — | — | |
| 15:10:27 | | | | 22.0 | — | — | — | — | — | 571 | — | ↑ Pump rate |
| 15:11:37 | | | | 23.0 | 15.64 | 0.78 | 475 | 7.51 | 91.2 | — | — | ↑ Pump rate |
| 15:12:46 | | | | 24.0 | ~~15~~— | — | — | — | — | 629 | — | |
| 15:13:45 | | | | 25.0 | 15.79 | 0.81 | 475 | 7.56 | 89.3 | — | — | |
| 15:14:53 | 15:14:53 | | | 26.0 | — | — | — | — | — | 638 | — | |
| 15:16:03 | 15:16:03 | | | 27.0 | 15.86 | 0.90 | 477 | 7.56 | 90.7 | 63 — | — | |

**Sample Analytes:** VOCs (8260)
Semi-Volatiles (8270)
Dissolved Fe and Mn (6020) (lab filtered)
Total Alkalinity as $CaCO_3$ (SM 2320B)
Sulfate, Nitrite, Nitrate, and Chloride (EPA 300.0)
Sulfide (SM 4500S2)
Ferric and Ferrous Iron (SM3500 Fe; Hach 8146)
Dissolved Methane, Ethane, and Ethene (RSK175)

**Ferrous Iron (field test) =**_______ mg/L

3 of 4

## Well Development / Purge Form

| | | | | | |
|---|---|---|---|---|---|
| Project | | Total Depth | | Depth Ind. S/N | |
| Project No. | 0488586 | Depth to Water (DTW) | | Weather | |
| Location | Canon City, CO | Water Column (ft. h.) | | | |
| Date | 12/11/18 | Casing Volume (gal) (2" = 0.16h, 4" = 0.66h) | | 3 vols = | |
| Well Number | Well 3 | Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h) | | | |
| Method | | Total Gallons Removed | | | |
| Field Personnel | | Sample Number & Time | Well3: Parkdale @ 15:35 | | |
| Setup time: | | | | | |

| Time | Duration (Minutes) | | | Volume (gallons) | Temp (°C) | DO (mg/L) | Spec. Cond. (µs/ms) | pH | ORP/ REDOX (ReL. | Turbidity (NTU) | DTW (ft btoc) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surge | Pump | Bail | | | | | | | | | |
| 15:17:15 | | | | 28.0 | — | — | — | — | — | — | — | |
| ~~15:~~ | | | | ~~29.0~~ | | | | | | | | No readings / time |
| 15:19:23 | | | | 30.0 | 15.85 | 1.04 | 478 | 7.59 | 89.3 | — | — | |
| 15:20:25 | | | | 31.0 | — | — | — | — | — | 549 | — | |
| 15:21:28 | | | | 32.0 | — | — | — | — | — | — | — | |
| 15:22:34 | | | | 33.0 | 16.23 | 1.09 | 482 | 7.64 | 86.9 | — | — | |
| 15:23:50 | | | | 34.0 | — | — | — | — | — | — | — | |
| 15:24:52 | | | | 35.0 | 16.27 | 1.05 | 481 | 7.60 | 88.5 | 422 | — | |
| 15:26:16 | | | | 36.0 | — | — | — | — | — | — | — | |
| 15:27:20 | | | | 37.0 | 16.35 | 0.99 | 480 | 7.63 | 88.6 | 635 | — | |
| 15:28:26 | | | | 38.0 | — | — | — | — | — | — | — | |
| 15:29:34 | | | | 39.0 | 16.40 | 0.95 | 480 | 7.65 | 88.5 | >1000 | | |
| 15:30:46 | | | | 40.0 | — | — | — | — | — | — | | |
| 15:32 | | | | | | | | | | | | ↓ Rate for sampling |

**Sample Analytes:** VOCs (8260)
Semi-Volatiles (8270)
Dissolved Fe and Mn (6020) (lab filtered)
Total Alkalinity as $CaCO_3$ (SM 2320B)
Sulfate, Nitrite, Nitrate, and Chloride (EPA 300.0)
Sulfide (SM 4500S2)
Ferric and Ferrous Iron (SM3500 Fe; Hach 8146)
Dissolved Methane, Ethane, and Ethene (RSK175)

**Ferrous Iron (field test) =**______ mg/L

4 of 4

# Well Development / Purge Form

| | | | | | |
|---|---|---|---|---|---|
| Project | | Total Depth | | Depth Ind. S/N | |
| Project No. | | Depth to Water (DTW) | | Weather | |
| Location | Canon City, CO | Water Column (ft. h.) | | | |
| Date | 12/11/18 | Casing Volume (gal) (2" = 0.16h, 4" = 0.66h) | | 3 vols = | |
| Well Number | Well 3 | Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h) | | | |
| Method | | Total Gallons Removed | | | |
| Field Personnel | | Sample Number & Time | | | |
| Setup time: | | | | | |

| Time | Duration (Minutes) | | | Volume (gallons) | Temp (°C) | DO (mg/L) | Spec. Cond. (µs/ms) | pH | ORP/ REDOX (ReL. | Turbidity (NTU) | DTW (ft btoc) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surge | Pump | Bail | | | | | | | | | |
| | | | | | | | | | | | | |
| 15:57:00 | | | | 48.5 | (+ samplex2) | | | | | | | ~~Ramped Q~~ ↑↑ Rat |
| 15:58 | | | | 50 | (+ Sample volume) | | | | | | | Stopped |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
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**Sample Analytes:** VOCs (8260)
Semi-Volatiles (8270)
Dissolved Fe and Mn (6020) (lab filtered)
Total Alkalinity as $CaCO_3$ (SM 2320B)
Sulfate, Nitrite, Nitrate, and Chloride (EPA 300.0)
Sulfide (SM 4500S2)
Ferric and Ferrous Iron (SM3500 Fe; Hach 8146)
Dissolved Methane, Ethane, and Ethene (RSK175)

**Ferrous Iron (field test)** =_______ mg/L

## Well Development / [✓ Purge] Form

|  |  |  |  |  |  |
|---|---|---|---|---|---|
| Project | Parkdale Quarry | Total Depth | 251' | Depth Ind. S/N |  |
| Project No. | 0488586 | static Depth to Water (DTW) | 11.28' | Weather | Mostly Sunny / 36 F |
| Location | Cañon City, CO | Water Column (ft. h.) |  |  |  |
| Date | 12/12/18 | Casing Volume (gal) (2" = 0.16h, 4" = 0.66h) |  | 3 vols = |  |
| Well Number | Well 10 | Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h) |  |  |  |
| Method | Grundos Redi Flo 2 | Total Gallons Removed |  |  |  |
| Field Personnel | PM & ZW | Sample Number & Time |  | @ 10:52 |  |
| Setup time: | 09:20 |  |  |  |  |

| Time | Duration (Minutes) |  |  | Volume (gallons) | Temp (°C) | DO (mg/L) | Spec. Cond. (µs/ms) | pH | ORP/ REDOX (ReL. | Turbidity (NTU) | DTW (ft btoc) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Surge | Pump | Bail |  |  |  |  |  |  |  |  |  |
| 09:49 |  | 0 |  | 0 |  |  |  |  |  |  |  | Start pump |
| 09:50:14 |  |  |  | 1 | 12.42 | 1.19 | 669 | 8.05 | -15.6 | Cloudy | — | silty |
| 09:51:24 |  |  |  | 2 |  |  |  |  |  |  | — |  |
| 09:52:44 |  |  |  | 3 |  |  |  |  |  |  | — | ↑ Pump rate |
| 09:53:26 |  |  |  | 4 | 12.73 | 0.30 | 646 | 7.96 | -34.5 | Cloudy | — |  |
| 09:55:20 |  |  |  | 5 |  |  |  |  |  |  |  | ↑ Pump rate |
| 09:56:25 |  |  |  | 6 | 12.90 | 0.29 | 627 | 7.91 | -38.0 | Cloudy | — |  |
| 09:57:29 |  |  |  | 7 |  |  |  |  |  |  |  |  |
| 09:58:34 |  |  |  | 8 | 13.01 | 0.60 | 617 | 7.88 | -37.8 | Cloudy | — |  |
| 09:59:35 |  |  |  | 9 |  |  |  |  |  |  |  |  |
| 10:00:36 |  |  |  | 10 |  |  |  |  |  |  |  |  |
| 10:01:40 |  |  |  | 11 | 13.21 | 1.35 | 613 | 7.83 | -32.0 | Cloudy | — |  |
| 10:02:33 |  |  |  | 12 |  |  |  |  |  |  |  |  |
| 10:03:20 |  |  |  | 13 | 13.24 | 1.70 | 611 | 7.81 | -28.1 | Cloudy | — |  |

**Sample Analytes:** VOCs (8260)
Semi-Volatiles (8270)
Dissolved Fe and Mn (6020) (lab filtered)
Total Alkalinity as $CaCO_3$ (SM 2320B)
Sulfate, Nitrite, Nitrate, and Chloride (EPA 300.0)
Sulfide (SM 4500S2)
Ferric and Ferrous Iron (SM3500 Fe; Hach 8146)
Dissolved Methane, Ethane, and Ethene (RSK175)

**Ferrous Iron (field test)** =_______ mg/L

2

# Well Development / Purge Form

Project
Project No. 0488586
Location Canon City, CO
Date 12/12/18
Well Number Well 10
Method Grundfos Redi-flow 2 ~1 gal/min
Field Personnel PM + ZW
Setup time:

Total Depth
Depth to Water (DTW)
Depth Ind. S/N
Weather
Water Column (ft. h.)
Casing Volume (gal) ([✓ 2"] = 0.16h, 4" = 0.66h) 3 vols =
Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h)
Total Gallons Removed
Sample Number & Time

| Time | Duration (Minutes) | | | Volume (gallons) | Temp (°C) | DO (mg/L) | Spec. Cond. (µs/ms) | pH | ORP/ REDOX (ReL. | Turbidity (NTU) | DTW (ft btoc) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surge | Pump | Bail | | | | | | | | | |
| 10:04:15 | | | | 14 | — | — | — | — | — | — | — | |
| 10:05:13 | | | | 15 | 13.25 | 2.00 | 607 | 8.03 | -26.1 | Cloudy | — | |
| 10:06:14 | | | | 16 | — | — | — | — | — | — | — | |
| 10:07:18 | | | | 17 | 13:28 | 2.21 | 585 | 7.74 | -15.1 | Cloudy | — | |
| 10:08:18 | | | | 18 | — | — | — | — | — | — | — | |
| 10:09:19 | | | | 19 | 13.30 | 2.25 | 568 | 7.72 | -9.9 | Cloudy | — | |
| 10:10:29 | | | | 20 | — | — | — | — | — | — | — | |
| 10:11:29 | | | | 21 | 13.29 | 2.36 | 604 | 7.70 | -3.4 | Cloudy | — | |
| 10:12:30 | | | | 22 | — | — | — | — | — | — | — | |
| 10:13:36 | | | | 23 | — | — | — | — | — | — | — | ↑ Pump rate |
| 10:14:38 | | | | 24 | 13.34 | 2.52 | 602 | 7.66 | -4.9 | Cloudy | — | |
| 10:15:38 | | | | 25 | — | — | — | — | — | — | — | |
| 10:16:40 | | | | 26 | 13.37 | 2.77 | 603 | 7.66 | 9.0 | Cloudy | — | |
| 10:17:39 | | | | 27 | — | — | — | — | — | — | — | |

**Sample Analytes:** VOCs (8260)
Semi-Volatiles (8270)
Dissolved Fe and Mn (6020) (lab filtered)
Total Alkalinity as $CaCO_3$ (SM 2320B)
Sulfate, Nitrite, Nitrate, and Chloride (EPA 300.0)
Sulfide (SM 4500S2)
Ferric and Ferrous Iron (SM3500 Fe; Hach 8146)
Dissolved Methane, Ethane, and Ethene (RSK175)

**Ferrous Iron (field test) =**_______ mg/L

# Well Development / Purge Form

Project
Project No.
Location
Date 12/12/18
Well Number Well 10
Method
Field Personnel
Setup time:

Total Depth
Depth to Water (DTW)
Water Column (ft. h.)
Casing Volume (gal) (2" = 0.16h, 4" = 0.66h) 3 vols =
Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h)
Total Gallons Removed
Sample Number & Time
Depth Ind. S/N
Weather

| Time | Duration (Minutes) | | | Volume (gallons) | Temp (°C) | DO (mg/L) | Spec. Cond. (µs/ms) | pH | ORP/ REDOX (ReL. | Turbidity (NTU) | DTW (ft btoc) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surge | Pump | Bail | | | | | | | | | |
| 10:18:40 | | | | 28 | 13.41 | 3.02 | 584 | 7.66 | 13.4 | Cloudy | — | |
| 10:19:40 | | | | 29 | | | | | | | | |
| 10:20:37 | | | | 30 | 13.44 | 3.04 | 570 | 7.65 | 17.2 | Cloudy | — | |
| 10:22:00 | | | | 31 | | | | | | | | |
| 10:23:10 | | | | 32 | 13.45 | 3.15 | 579 | 7.64 | 21.8 | Cloudy | — | |
| 10:25:10 | | | | 34 | 13.46 | 3.29 | 576 | 7.62 | 24.8 | >1000 | — | |
| 10:27:10 | | | | 36 | 13.49 | 3.47 | 575 | 7.60 | 27.4 | >1000 | — | |
| 10:29:10 | | | | 38 | 13.48 | 3.69 | 574 | 7.60 | 29.9 | >1000 | — | |
| 10:31:22 | | | | 40 | 13.51 | 3.96 | 587 | 7.59 | 32.5 | >1000 | — | |
| 10:34:10 | | | | 43 | 13.59 | 4.26 | 591 | 7.58 | 34.3 | >1000 | — | |
| 10:36:09 | | | | 45 | 13.63 | 4.46 | 594 | 7.57 | 36.3 | >1000 | — | |
| 10:37:55 | | | | | | | | | | | | ↓ Pump rate |
| 10:38:22 | | | | 47 | 13.56 | 4.48 | 596 | 7.59 | 36.8 | >1000 | — | |
| 10:40:07 | | | | 48 | 13.36 | 4.48 | 597 | 7.57 | 39.2 | >1000 | — | |

**Sample Analytes:** VOCs (8260)
Semi-Volatiles (8270)
Dissolved Fe and Mn (6020) (lab filtered)
Total Alkalinity as $CaCO_3$ (SM 2320B)
Sulfate, Nitrite, Nitrate, and Chloride (EPA 300.0)
Sulfide (SM 4500S2)
Ferric and Ferrous Iron (SM3500 Fe; Hach 8146)
Dissolved Methane, Ethane, and Ethene (RSK175)

**Ferrous Iron (field test) =**_______ mg/L

# Well Development / Purge Form

4

Project
Project No.
Location Canon City, CO
Date 12/12/18
Well Number Well 10
Method
Field Personnel Pm + Zw
Setup time:

Total Depth
Depth to Water (DTW)
Water Column (ft. h.)
Casing Volume (gal) (2" = 0.16h, 4" = 0.66h) 3 vols =
Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h)
Total Gallons Removed
Sample Number & Time @ 10:52

Depth Ind. S/N
Weather

| Time | Duration (Minutes) | | | Volume (gallons) | Temp (°C) | DO (mg/L) | Spec. Cond. (µs/ms) | pH | ORP/ REDOX (ReL. | Turbidity (NTU) | DTW (ft btoc) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surge | Pump | Bail | | | | | | | | | |
| 10:41:45 | | | | 49 | 13.33 | 4.47 | 597 | 7.49 | 44.2 | >1000 | — | |
| 10:43:21 | | | | 50 | — | — | — | — | — | >1000 | — | |
| 10:44:49 | | | | 51 | 13.39 | 4.35 | 600 | 7.52 | 45.0 | >1000 | — | |
| 10:46:23 | | | | 52 | 13.40 | 4.29 | 601 | 7.52 | 46.4 | >1000 | — | |
| 10:47:52 | | | | 53 | 13.41 | 4.23 | 602 | 7.55 | 47.6 | >1000 | — | |
| 10:49:12 | | | | 54 | 13.43 | 4.20 | 602 | 7.55 | 48.7 | >1000 | — | Very Turbid |
| 10:52 | | | | — | — | — | — | — | — | — | — | COLLECT SAMPLE |
| 11:09:00 | | | | 63.5 | (+Sample volume x 2) | | | | | | | |
| 11:10:30 | | | | 65 | | | | | | | | ↑↑ Rate |
| 11:12:12 | | | | 67 | | | | | | | | |
| 11:13:38 | | | | 69 | | | | | | | | ↑ Rate |
| 11:14:11 | | | | 70 | | | | | | | | |
| 11:17:15 | | | | 75 | | | | | | | | |
| 11:20:14 | | | | 80 | | | | | | | | |

**Sample Analytes:** VOCs (8260)
Semi-Volatiles (8270)
Dissolved Fe and Mn (6020) (lab filtered)
Total Alkalinity as $CaCO_3$ (SM 2320B)
Sulfate, Nitrite, Nitrate, and Chloride (EPA 300.0)
Sulfide (SM 4500S2)
Ferric and Ferrous Iron (SM3500 Fe; Hach 8146)
Dissolved Methane, Ethane, and Ethene (RSK175)

**Ferrous Iron (field test) =** _______ mg/L

# Well Development / Purge Form

Project MM Spring GW Sampling
Project No.
Location ~~Well 4~~, Parkdale Quarry
Date 5/14/2019
Well Number well-1
Method pumping
Field Personnel Zeek Walter Morgan Farmer

Total Depth 239
Depth. Ind. S/N
Depth to Water 123.99
Weather Sunny, Sligh breeze
Water Column (ft. h.) 115.01
Casing Volume (gal) (2" = 0.16h, 4" = 0.66h) 18 gal
Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h)
Total Gallons Removed
Sample Number & Time

| Time | Duration (Minutes) | | | Volume (gallons) | Temp (°C) | DO (mg/L) | Spec Cond. ~~(µs/ms)~~ ms/cm | pH | ORP/ REDOX (ReL. ~~M~~mV) | Turbidity (NTU) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surge | Pump | Bail | | | | | | | | |
| 1215 | | | | 2 | 15.61 | 13.55 | .484 | 7.49 | 178 | — | very turbid water |
| 1233 | | | | 4 | 15.30 | 12.53 | .489 | 7.51 | 165 | — | pump technical difficulties |
| 1253 | | | | 6 | 17.01 | 6.02 | .485 | 7.3 | 158 | — | more technical difficulties |
| 1305 | | | | 8 | 18.99 | 4.71 | .482 | 7.16 | ~~18~~ 147 | 530 | |
| 1313 | | | | 10 | 18.88 | 4.89 | .483 | 7.13 | 137 | 701 | |
| 1319 | | | | 12 | 19.74 | 4.50 | .480 | 7.13 | 131 | 626 | |
| 1325 | | | | 14 | 19.58 | 4.52 | .481 | 7.14 | 125 | 780 | since tubing was exposed to sunlight when pump was pulled up, temp maybe off. |

Sample Analytes: BTEX Napthalene (8020) TVPH (gas) 8015mod TEPH (diesel) 8015 mod Napthalene (8270) PAHs (610)
Nitrate Glycols RCRA Metals F N/F VOC (8260) Semi-Volatiles (8270)
General Water Chemistry (cations plus manganese, anions, chloride, sulfate, bicarbonate, and total alkalinity)

# Well Development / Purge Form

Project MM Spring GW Sampling
Project No.
Location Pancake Quarry
Date 5/14/2019
Well Number well-1
Method pumping
Field Personnel Zeek Walter, Morgan Farmer

Total Depth 239
Depth. Ind. S/N
Depth to Water 123.99
Weather
Water Column (ft. h.) 115.01
Casing Volume (gal) (2″ = 0.16h, 4″ = 0.66h) 19 gal
Borehole Volume (gal) (2″ = 0.73h, 4″ = 1.15h)
Total Gallons Removed
Sample Number & Time

| Time | Duration (Minutes) | | | Volume (gallons) | Temp (°C) | DO (mg/L) | Spec Cond. ~~(µs/ms)~~ ms/cm | pH | ORP/ REDOX (ReL. ~~M~~mV) | Turbidity (NTU) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surge | Pump | Bail | | | | | | | | |
| 1330 | | | | 16 | 19.97 | 4.19 | .479 | 7.15 | 126 | 845 | |
| 1338 | | | | 18 | 20.26 | 3.98 | .475 | 7.16 | 127 | 920 | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Sample Analytes: BTEX Napthalene (8020) TVPH (gas) 8015mod TEPH (diesel) 8015 mod Napthalene (8270) PAHs (610)
Nitrate Glycols RCRA Metals F N/F VOC (8260) Semi-Volatiles (8270)
General Water Chemistry (cations plus manganese, anions, chloride, sulfate, bicarbonate, and total alkalinity)

# Well Development / Purge Form

| | | | |
|---|---|---|---|
| Project | Martin Marieta Spring GW Sampling | Total Depth | 249 - Said field guy<br>N/A |
| | | Depth. Ind. S/N | |
| Project No. | | Depth to Water | 38.38ft |
| | | Weather | sunny, slight breeze |
| Location | Canyon City | Water Column (ft. h.) | 249 - 38.38 = ft |
| Date | 5/13/2019 | Casing Volume (gal) (2" = 0.16h, 4" = 0.66h) | (249.0 - 38.38)*.16 = 33.7 gal |
| Well Number | MW-3 | Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h) | |
| Method | | Total Gallons Removed | |
| Field Personnel | Zack Walter, Morgan Farmer | Sample Number & Time | |

| Time | Duration (Minutes) | | | Volume (gallons) | Temp (°C) | DO (mg/L) | Spec Cond (~~µs/ms~~ mS/cm) | pH | ORP/ REDOX (ReL. MV) | Turbidity (NTU) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surge | Pump | Bail | | | | | | | | |
| 1218 | | | | 1 | 14.80 | 20.36 | .380 mS/cm | 7.39 | 162 | 315 | |
| 1220 | | | | 3 | 14.97 | 14.43 | .381 mS/cm | 7.07 | 113 | 89.1 | |
| 1222 | | | | 5 | 15.13 | 12.47 | .380 | 6.84 | 109 | 175 | |
| 1224 | | | | 7 | 15.23 | 11.20 | .380 | 6.73 | 124 | 92.7 | |
| 1227 | | | | 9 | 15.30 | 10.30 | .379 | 6.68 | 132 | 80.0 | |
| 1229 | | | | 11 | 15.39 | 9.72 | .379 | 6.66 | 132 | 92.5 | |
| 1231 | | | | 13 | 15.47 | 9.23 | .379 | 7.51 | 88 | 96.1 | |

Sample Analytes: BTEX Napthalene (8020) TVPH (gas) 8015mod TEPH (diesel) 8015 mod Napthalene (8270) PAHs (610)

Nitrate Glycols RCRA Metals F N/F VOC (8260) Semi-Volatiles (8270)

General Water Chemistry (cations plus manganese, anions, chloride, sulfate, bicarbonate, and total alkalinity)

pg 1

# Well Development / Purge Form

Project Martin Marieta Spring GW Sampling
Project No.
Location Canyon City
Date 5/13/2009
Well Number MW-3
Method
Field Personnel Morgan Farmer, Zack Walter

Total Depth 249.0
Depth. Ind. S/N
Depth to Water 38.38
Weather
Water Column (ft. h.)
Casing Volume (gal) (2" = 0.16h, 4" = 0.66h) 33.7 gal
Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h)
Total Gallons Removed
Sample Number & Time

| Time | Duration (Minutes) | | | Volume (gallons) | Temp (°C) | DO (mg/L) | Spec Cond ms/cm (µs/ms) | pH | ORP/ REDOX (ReL. MV) | Turbidity (NTU) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surge | Pump | Bail | | | | | | | | |
| 12:34 | un | | | 15 | 15.56 | 8.90 | .380 | 7.53 | 89 | 95.0 | |
| 12 37 | | | | 17 | 15.66 | 8.67 | .380 | 7.52 | 89 | 101 | |
| 12:40 | | | | 19 | 15.80 | 8.36 | .380 | 7.53 | 86 | 110 | |
| 1243 | | | | 21 | 15.88 | 8.12 | .380 | 7.54 | 82 | 117 | |
| 1247 | | | | 23 | 15.85 | 8.04 | .381 | 7.26 | 89 | 138 | |
| 1253 | | | | 25 | 16.08 | 8.36 | .381 | 7.07 | 98 | 157 | |
| | | | | 27 | 16.04 | ~~7.8~~ 8.00 | .381 | 7.07 | 99 | 153 | |

Sample Analytes: BTEX Napthalene (8020) TVPH (gas) 8015mod TEPH (diesel) 8015 mod Napthalene (8270) PAHs (610)
Nitrate Glycols RCRA Metals F N/F VOC (8260) Semi-Volatiles (8270)
General Water Chemistry (cations plus manganese, anions, chloride, sulfate, bicarbonate, and total alkalinity)

pg 2

# Well Development / Purge Form

| | | | |
|---|---|---|---|
| Project | Martin Marieta Spring GW Sampling | Total Depth | 249.0 |
| | | Depth. Ind. S/N | |
| Project No. | | Depth to Water | 38.38 |
| | | Weather | |
| Location | Canyon City | Water Column (ft. h.) | |
| Date | | Casing Volume (gal) (2″ = 0.16h, 4″ = 0.66h) | 537 gal |
| Well Number | MW-3 | Borehole Volume (gal) (2″ = 0.73h, 4″ = 1.15h) | |
| Method | | Total Gallons Removed | |
| Field Personnel | Morgan Farme, Zack Walker | Sample Number & Time | |

| Time | Duration (Minutes) | | | Volume (gallons) | Temp (°C) | DO (mg/L) | Spec Cond. ms cm (µs/ms) | pH | ORP/ REDOX (ReL. MV) | Turbidity (NTU) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surge | Pump | Bail | | | | | | | | |
| 1256 | | | | 29 | 16.24 | 8.11 | .381 | 6.95 | 101 | 168 | |
| 1258 | | | | 31 | 16.21 | 7.90 | .381 | 6.93 | 103 | 190 | |
| 1301 | | | | 33 | 16.30 | 7.63 | .380 | 6.94 | 101 | 190 | |
| 1304 | | | | 35 | 16.38 | 7.51 | .379 | 6.97 | 96 | 205 | |
| 1308 | | | | 37 | 16.44 | 7.28 | .380 | 7.22 | 85 | 222 | |
| 1311 | | | | 39 | 16.50 | 7.13 | .380 | 7.60 | 65 | 216 | |
| 1314 | | | | 41 | 16.53 | 7.97 | .381 | 7.35 | 76 | 222 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Sample Analytes: | BTEX | Napthalene (8020) | TVPH (gas) 8015mod | TEPH (diesel) 8015 mod | Napthalene (8270) | PAHs (610) |
| | Nitrate | Glycols | RCRA Metals F N/F | VOC (8260) | Semi-Volatiles (8270) | |

General Water Chemistry (cations plus manganese, anions, chloride, sulfate, bicarbonate, and total alkalinity)

pg 3

# Well Development / Purge Form

| | | | | | |
|---|---|---|---|---|---|
| Project | Martin Marietta Spring GW Sampling | Total Depth | 249.0 | Depth. Ind. S/N | |
| Project No. | | Depth to Water | 38.38 | Weather | |
| Location | Canyon City | Water Column (ft. h.) | | | |
| Date | 5/13/2019 | Casing Volume (gal) (2" = 0.16h, 4" = 0.66h) | | | |
| Well Number | MW - 3 | Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h) | | | |
| Method | | Total Gallons Removed | | | |
| Field Personnel | Zack Walter, Morgan Farmer | Sample Number & Time | | | |

| Time | Duration (Minutes) | | | Volume (gallons) | Temp (°C) | DO (mg/L) | Spec Cond. ms/cm ~~(µs/ms)~~ | pH | ORP/ REDOX (ReL. ~~M~~mV) | Turbidity (NTU) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surge | Pump | Bail | | | | | | | | |
| 1316 | | | | 43 | 16.76 | 6.82 | .380 | 7.09 | 81 | 209 | |
| 1318 | | | | 45 | 16.66 | 7.38 | .380 | 7.01 | 86 | 200 | |
| 1321 | | | | 47 | 16.73 | 7.02 | .380 | 7.00 | 87 | 256 | |
| 1324 | | | | 49 | 16.90 | 6.71 | .379 | 7.05 | 85 | 429 | |
| 1326 | | | | 57 | ~~16~~ 17.00 | 6.41 | .379 | 7.12 | 70 | 821 | |
| | | | | 59 | 17.13 | 6.20 | .378 | 7.71 | 49 | 0.0 | |
| | | | | | | | | | | | |

Sample Analytes: BTEX Napthalene (8020) TVPH (gas) 8015mod TEPH (diesel) 8015 mod Napthalene (8270) PAHs (610)

Nitrate Glycols RCRA Metals F N/F VOC (8260) Semi-Volatiles (8270)

General Water Chemistry (cations plus manganese, anions, chloride, sulfate, bicarbonate, and total alkalinity)

# Well Development / Purge Form

| | | | |
|---|---|---|---|
| Project | Martin Marieta Spring GW Sampling | Total Depth | Depth. Ind. S/N |
| Project No. | | Depth to Water | 10.17 Weather |
| Location | Parkdale quarry | Water Column (ft. h.) | |
| Date | 5/~~18~~13/2019 | Casing Volume (gal) (2" = 0.16h, 4" = 0.66h) | |
| Well Number | MW-10 | Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h) | |
| Method | pumping | Total Gallons Removed | |
| Field Personnel | Morgan Farmer, Zeek Walter | Sample Number & Time | |

| Time | Duration (Minutes) | | | Volume (gallons) | Temp (°C) | DO (mg/L) | Spec Cond. mS/cm (~~µs~~/ms) | pH | ORP/ REDOX (ReL. MV) | Turbidity (NTU) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surge | Pump | Bail | | | | | | | | |
| 1611 | | | | 44 | 12.93 | 5.20 | .481 | 6.63 | 107 | 503 | |
| 1613 | | | | 46 | 12.92 | 5.22 | .480 | 6.62 | 108 | 450 | |
| 1614 | | | | 48 | 12.85 | 5.12 | .480 | 6.62 | 109 | 419 | |
| 1616 | | | | 50 | 12.86 | 5.05 | .480 | 6.64 | 110 | 478 | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Sample Analytes: BTEX Napthalene (8020) TVPH (gas) 8015mod TEPH (diesel) 8015 mod Napthalene (8270) PAHs (610)

Nitrate Glycols RCRA Metals F N/F VOC (8260) Semi-Volatiles (8270)

General Water Chemistry (cations plus manganese, anions, chloride, sulfate, bicarbonate, and total alkalinity)

# Well Development / Purge Form

Project: Martin Marietta Spring MW Sampling
Project No.:
Location: Parkdale Quarry
Date: 5/13/2019
Well Number: MW-10
Method: pumping
Field Personnel: Morgan Farmer, Zack Walter

Total Depth:
Depth. Ind. S/N:
Depth to Water: 10.17
Weather:
Water Column (ft. h.):
Casing Volume (gal) (2" = 0.16h, 4" = 0.66h):
Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h):
Total Gallons Removed:
Sample Number & Time:

| Time | Duration (Minutes) | | | Volume (gallons) | Temp (°C) | DO (mg/L) | Spec Cond. mS/cm ~~(µs/ ms)~~ | pH | ORP/ REDOX (ReL. ~~MV~~ mV) | Turbidity (NTU) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surge | Pump | Bail | | | | | | | | |
| 1551 | | | | 30 | 13.06 | 5.93 | .495 | 6.62 | 108 | 656 | |
| ~~15~~ 16.00 | | | | 32 | 13.04 | 5.72 | .491 | 6.62 | 105 | 777 | |
| 16.02 | | | | 34 | 13.03 | 5.65 | .485 | 6.63 | 106 | 926 | |
| 1603 | | | | 36 | 13.06 | 5.48 | .482 | 6.63 | 105 | 906 | |
| 1605 | | | | 38 | 13.01 | 5.41 | .480 | 6.64 | 104 | 779 | |
| ~~16.06~~ 16.07 | | | | 40 | 13.00 | 5.41 | .480 | 6.64 | 105 | 651 | |
| 1609 | | | | 42 | ~~13.~~ 12.99 | 5.24 | .480 | 6.62 | 107 | 570 | |

Sample Analytes: BTEX, Napthalene (8020), TVPH (gas) 8015mod, TEPH (diesel) 8015 mod, Napthalene (8270), PAHs (610)
Nitrate, Glycols, RCRA Metals F N/F, VOC (8260), Semi-Volatiles (8270)
General Water Chemistry (cations plus manganese, anions, chloride, sulfate, bicarbonate, and total alkalinity)

pg 3

# Well Development / Purge Form

Project: Martin Marietta Spring GW Sampling
Project No.:
Location: Parkdale Quarry
Date: 5/13/2019
Well Number: MW-10
Method: pumping
Field Personnel: zach water, morgan farmer

Total Depth:
Depth. Ind. S/N:
Depth to Water: 10.17
Weather:
Water Column (ft. h.):
Casing Volume (gal) (2″ = 0.16h, 4″ = 0.66h):
Borehole Volume (gal) (2″ = 0.73h, 4″ = 1.15h):
Total Gallons Removed:
Sample Number & Time:

| Time | Duration (Minutes) | | | Volume (gallons) | Temp (°C) | DO (mg/L) | Spec Cond. ms/cm (~~µs~~/ms) | pH | ORP/ REDOX (ReL. m~~M~~V) | Turbidity (NTU) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surge | Pump | Bail | | | | | | | | |
| 1545 | | | | 16 | 13.29 | 7.79 | .502 | 6.73 | 102 | — | |
| 5.46 | | | | 18 | 13.26 | 7.50 | .502 | 6.71 | 102 | — | |
| 1549 | | | | 20 | 13.27 | 7.12 | .502 | 6.70 | 100 | — | |
| 1551 | | | | 22 | 13.22 | 6.86 | .500 | 6.06 | 105 | | |
| 1552 | | | | 24 | 13.21 | 6.38<br>~~6.09~~ | .498 | 6.64 | 105 | 918 | |
| 15 54 | | | | 26 | 13.14 | 6.28 | .497 | 6.64 | 106 | 946 | |
| 15 56 | | | | 28 | 13.09 | 6.17 | .496 | 6.63 | 108 | 691 | |

Sample Analytes: BTEX Napthalene (8020) TVPH (gas) 8015mod TEPH (diesel) 8015 mod Napthalene (8270) PAHs (610)

Nitrate Glycols RCRA Metals F N/F VOC (8260) Semi-Volatiles (8270)

General Water Chemistry (cations plus manganese, anions, chloride, sulfate, bicarbonate, and total alkalinity)

pg 2

pump on 15 30

# Well Development / Purge Form

| | | | |
|---|---|---|---|
| Project | Martin Marietta Spring GW Sampling | Total Depth | |
| | | Depth. Ind. S/N | |
| Project No. | | Depth to Water | 10.17 |
| | | Weather | |
| Location | Parkdale Quarry | Water Column from TOC (ft. h.) | |
| Date | 5/13/2019 | Casing Volume (gal) (2" = 0.16h, 4" = 0.66h) | |
| Well Number | MM-10 | Borehole Volume (gal) (2" = 0.73h, 4" = 1.15h) | |
| Method | pumping | Total Gallons Removed | |
| Field Personnel | Morgan Farmer, Zeek Walter | Sample Number & Time | |

| Time | Duration (Minutes) | | | Volume (gallons) | Temp (°C) | DO (mg/L) | Spec Cond. mS/cm (~~µs/ms~~) | pH | ORP/ REDOX (ReL. ~~MV~~ mV) | Turbidity (NTU) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surge | Pump | Bail | | | | | | | | |
| 1532 | | | | 2 | 13.13 | 15.21 | .812 | 7.22 | 32 | ~~0~~ | |
| 1534 | | | | 4 | 13.22 | 12.46 | .509 | 7.05 | 36 | ~~NA~~ | |
| 1536 | | | | 6 | 13.28 | 10.43 | .504 | 6.96 | 33 | 1000 | 1000 flashing |
| 1538 | | | | 8 | 12.94 | 9.53 | .504 | 6.87 | 68 | — | moved pump higher in well, very turbid water |
| 1540 | | | | 10 | 13.11 | 8.80 | .504 | 6.81 | 87 | — | |
| 1542 | | | | 12 | 13.16 | 8.10 | .505 | 6.81 | 94 | — | water starting to clear |
| 1543 | | | | 14 | 13.20 | 7.94 | .502 | 6.79 | 100 | | |

Sample Analytes: BTEX Napthalene (8020) TVPH (gas) 8015mod TEPH (diesel) 8015 mod Napthalene (8270) PAHs (610)

Nitrate Glycols RCRA Metals F N/F VOC (8260) Semi-Volatiles (8270)

General Water Chemistry (cations plus manganese, anions, chloride, sulfate, bicarbonate, and total alkalinity)

# APPENDIX B ANALYTICAL REPORTS

Martin Marietta Parkdale Quarry: Field Water Quality

| | Date | Temperature | DO | Specific Conductance | pH | ORP | Turbidity |
|---|---|---|---|---|---|---|---|
| Regulation/Well Name | Units | Deg C | mg/L | µS/ms | | ReL. | NTU |
| Domestic Water Supply | | | | | | | |
| Aquatic Life Acute | | | | | | | |
| Aquatic Life Chronic | | | 3 | | 6.5-9.0 | | |
| | | | | | | | |
| Well 1 | 12/11/2018 | 14.68 | 4.37 | 587 | 7.71 | 127 | 743 |
| Well 1 | 5/14/2019 | 20.26 | 3.98 | 475 | 7.16 | 127 | 920 |
| Well 3 | 12/11/2018 | 16.4 | 0.95 | 480 | 7.65 | 88.5 | > 1000 |
| Well 3 | 5/13/2019 | 17.0 | 6.41 | 379 | 7.12 | 70 | 821 |
| Well 10 | 12/12/2018 | 13.43 | 4.2 | 602 | 7.55 | 48.7 | > 1000 |
| Well 10 | 5/13/2019 | 12.86 | 5.05 | 480 | 6.64 | 110 | 478 |

Colorado Department of Public Health and Environment Water Quality Control Commission

Regulation No. 31 - The Basic Standards and Methodologies for Surface Water

https://www.colorado.gov/pacific/sites/default/files/31_2018%2801%29.pdf

* aquatic life fomulas based on mean hardness of 200 mg/L CaCO3

Exceeds Domestic Water Supply Standards

Martin Marietta Parkdale Quarry: Major Ions and Metals

|  | Date | Alkalinity, Total as CaCO3 | Chloride | Nitrogen, Nitrate | Phosphorus, Total | Solids, Total Dissolved | Sulfate | Aluminum | Antimony | Arsenic | Barium | Cadmium | Calcium | Chromium | Cobalt a | Copper | Iron | Lead | Magnesium | Manganese | Molybdenum | Nickel | Potassium | Selenium | Silicon | Sodium | Uranium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Regulation/Well Name | Units | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| Domestic Water Supply |  |  | 250 | 10 |  | 500 | 250 |  | 6 | 10 | 1000 | 5 |  | 50 |  | 200 | 300 | 50 |  | 50 | 210 | 100 |  | 50 |  |  | 30 | 5000 |
| Aquatic Life Acute |  |  |  |  |  |  |  | 8838* |  | 340 |  | 5* |  | 16* |  | 26* |  | 136* |  | 3761* | 300 | 842* |  | 18.4 |  |  | 5157* | 301* |
| Aquatic Life Chronic |  |  |  |  |  |  |  | 1262* |  | 150 |  | 0.72* |  | 11* |  | 16* |  | 5.3* |  | 2078* |  | 94* |  | 4.6 |  |  | 3221* | 228* |
| Well 1 | 12/11/2018 | 190 | 8 | 5.7 | 0.28 | 406 | 99 | < 100 | < 0.80 | < 0.40 | 18.3 | < 0.20 | 67600 | < 4.0 | < 2.0 | < 4.0 | 179 | < 1.0 | 15800 | 5 | 40 | 5.2 | 2900 | 2.9 | 7660 | 23700 | 17.3 | < 20 |
| Well 1 | 5/14/2019 | 188 | 7.5 | 6.5 | 0.31 | 417 | 95.8 | < 100 | < 0.80 | 0.4 | 20.7 | < 0.20 | 75800 | < 4.0 | < 1.0 [a] | < 4.0 | 122 | < 1.0 | 15100 | 2.9 | 18.8 | < 4.0 | 3030 | 3.8 | 7640 | 23100 | 13.7 | < 20 |
| Well 3 | 12/11/2018 | 176 | 11.6 | 1.9 | 0.98 | 338 | 63.2 | < 100 | < 0.80 | 0.59 | 31.4 | < 0.20 | 50200 | < 4.0 | < 0.40 | < 4.0 | 139 | < 1.0 | 11400 | 9.8 | 141 | < 4.0 | 2360 | 3.2 | 9950 | 30700 | 21.2 | < 20 |
| Well 3 | 5/13/2019 | 168 | 9.9 | 2.6 | 0.41 | 318 | 55.7 | < 100 | < 0.80 | 0.43 | 18.9 | < 0.20 | 48100 | < 4.0 | < 0.40 | < 4.0 | 82.2 | < 1.0 | 10600 | 12.8 | 155 | 11.2 | 2130 | 2.2 | 10700 | 28200 | 19.7 | < 20 |
| Well 10 | 12/12/2018 | 253 | 8 | 0.12 | 3.1 | 437 | 86.3 | < 100 | < 0.80 | 0.42 | 39.1 | < 0.20 | 81400 | < 4.0 | < 2.0 | 8.4 | 221 | < 1.0 | 16500 | 24.1 | 38.3 | 10.2 | 2550 | 1.2 | 13000 | 22600 | 38.2 | < 20 |
| Well 10 | 5/13/2019 | 228 | 7.5 | 0.087 | 0.81 | 420 | 85.9 | < 100 | < 0.80 | 0.4 | 34 | < 0.20 | 76400 | < 4.0 | < 2.0 [a] | 5.2 | 140 | < 1.0 | 14800 | 5 | 7.3 | < 4.0 | 1640 | 1.2 | 13200 | 20000 | 16.7 | < 20 |

Colorado Department of Public Health and Environment Water Quality Control Commission

Regulation No. 31 - The Basic Standards and Methodologies for Surface Water

https://www.colorado.gov/pacific/sites/default/files/31_2018%2801%29.pdf

* aquatic life fomulas based on mean hardness of 200 mg/L CaCO3

Exceeds Domestic Water Supply Standards

Martin Marietta Parkdale Quarry: Radionuclides

| | Date | Gross Alpha | Gross Beta | Radium 226 | Radium 228 | Uranium 234 | Uranium 235 | Uranium 238 |
|---|---|---|---|---|---|---|---|---|
| Regulation/Well Name | Units | pCi/L | pCi/L | pCi/L | pCi/L | pCi/L | pCi/L | pCi/L |
| Domestic Water Supply | | 15 | 4 mrems per year (50 pCi/L screening) | 5 (226 and 228 combined) | 5 (226 and 228 combined) | 30 | 30 | 30 |
| Aquatic Life Acute | | | | | | | | |
| Aquatic Life Chronic | | | | | | | | |
| Well 1 | 12/11/2018 | 19 | 22 | 1 | 1.5 | 16 | 0.07 | 9.06 |
| Well 1 | 5/14/2019 | 18 | 28 | 1.2 | 2.7 | 19 | 0 | 6.45 |
| Well 3 | 12/11/2018 | 47 | 71 | 2.3 | 2.2 | 21 | 1.2 | 9.99 |
| Well 3 | 5/13/2019 | 47 | 65 | 1.3 | 9.7 | 17 | -0.27 | 7.28 |
| Well 10 | 12/12/2018 | 120 | 200 | 4.4 | 3.1 | 25 | 0.96 | 17.2 |
| Well 10 | 5/13/2019 | 25 | 34 | 1.4 | 2.6 | 11 | -0.64 | 7.44 |

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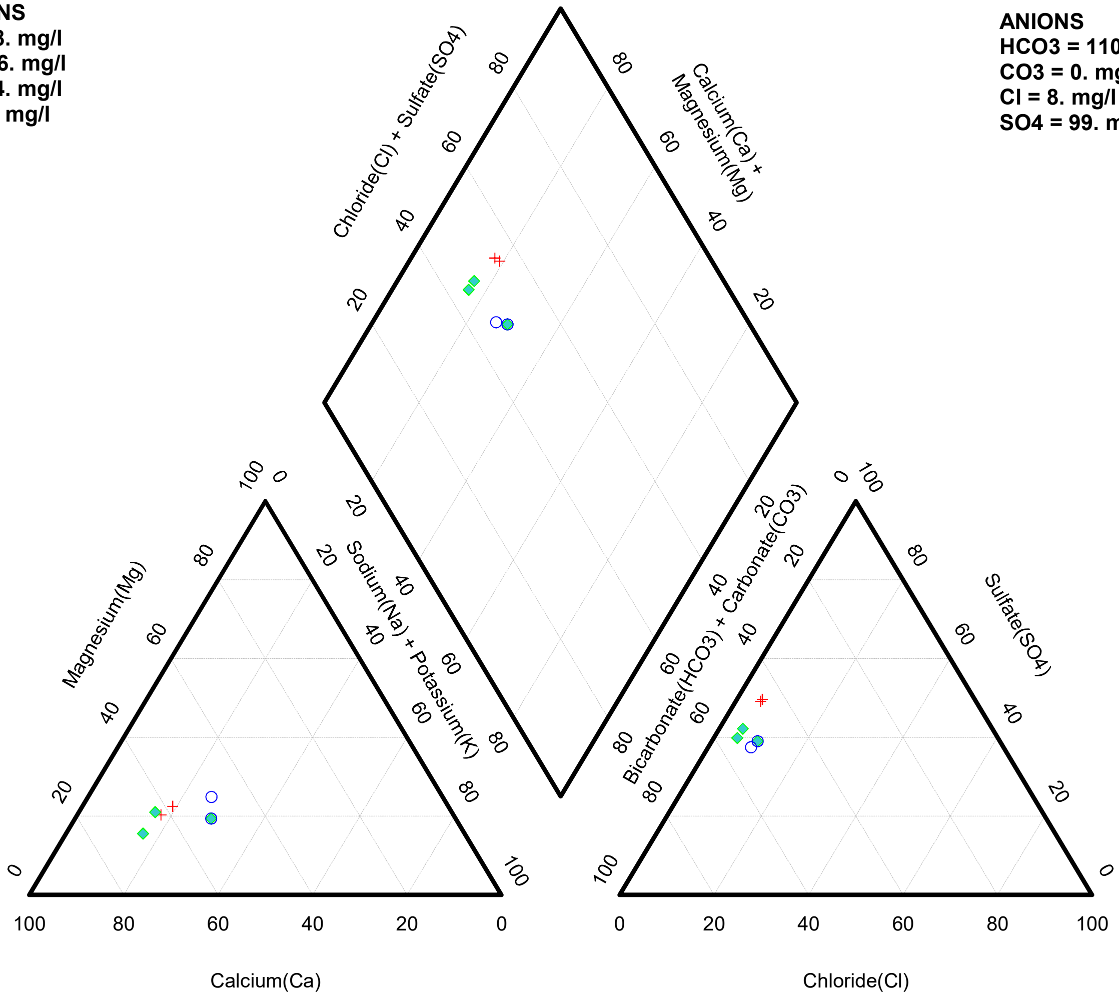
https://www.colorado.gov/pacific/sites/default/files/31_2018%2801%29.pdf
* aquatic life fomulas based on mean hardness of 200 mg/L CaCO3
Exceeds Domestic Water Supply Standards

Piper Plot

**CATIONS**
**Ca = 68. mg/l**
**Mg = 16. mg/l**
**Na = 24. mg/l**
**K = 2.9 mg/l**

**ANIONS**
**HCO3 = 110. mg/l**
**CO3 = 0. mg/l**
**Cl = 8. mg/l**
**SO4 = 99. mg/l**



SGS

Wheat Ridge, CO

12/28/18

The results set forth herein are provided by SGS North America Inc.

*e-Hardcopy 2.0*
*Automated Report*

# Technical Report for

ERM-West, Inc.

Parkdale Quarry GW

0488586

SGS Job Number: DA11888

Sampling Dates: 12/11/18 - 12/12/18

Report to:

ERM-West, Inc.
555 17th Street Suite #1700
Denver, CO 80111
zack.walker@erm.com; Paul.Mehring@erm.com

ATTN: Zach Walker

Total number of pages in report: **35**

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Scott Heideman
Laboratory Director

Client Service contact: Carissa Cumine 303-425-6021

Certifications: CO (CO00049), ID (CO00049), NE (NE-OS-06-04), ND (R-027), NJ (CO007), OK (D9942) UT (NELAP CO00049), LA (LA150028), TX (T104704511), WY (8TMS-L)

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# Sample Summary

ERM-West, Inc.

**Job No:** DA11888

Parkdale Quarry GW
Project No: 0488586

| Sample Number | Collected | | | Received | Matrix | | Client Sample ID |
|---|---|---|---|---|---|---|---|
| | Date | Time | By | | Code | Type | |
| DA11888-1 | 12/11/18 | 11:28 PM | | 12/12/18 | AQ | Ground Water | WELL 1:PARKDALE |
| DA11888-1F | 12/11/18 | 11:28 PM | | 12/12/18 | AQ | Groundwater Filtered | WELL 1:PARKDALE |
| DA11888-3 | 12/11/18 | 15:35 PM | | 12/12/18 | AQ | Ground Water | WELL 3:PARKDALE |
| DA11888-3F | 12/11/18 | 15:35 PM | | 12/12/18 | AQ | Groundwater Filtered | WELL 3:PARKDALE |
| DA11888-5 | 12/12/18 | 10:52 PM | | 12/12/18 | AQ | Ground Water | WELL 10:PARKDALE |
| DA11888-5F | 12/12/18 | 10:52 PM | | 12/12/18 | AQ | Groundwater Filtered | WELL 10:PARKDALE |

# CASE NARRATIVE / CONFORMANCE SUMMARY

| | | | |
|---|---|---|---|
| **Client:** | ERM-West, Inc. | **Job No** | DA11888 |
| **Site:** | Parkdale Quarry GW | **Report Date** | 12/27/2018 2:49:25 P |

On 12/12/2018, 3 sample(s), 0 Trip Blank(s), and 0 Field Blank(s) were received at SGS North America Inc. (SGS) at a temperature of 1.1 °C. The samples were intact and properly preserved, unless noted below. An SGS Job Number of DA11888 was assigned to the project. The lab sample ID, client sample ID, and date of sample collection are detailed in the report's Results Summary.

Specified quality control criteria were achieved for this job except as noted below. For more information, please refer to the analytical results and QC summary pages.

## Metals Analysis By Method EPA 200.7

**Matrix:** AQ **Batch ID:** MP26974

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA11917-1MS, DA11917-1MSD were used as the QC samples for the metals analysis.
- MP26974-MB1 for Silicon: All sample results >10x method blank concentration.

## Metals Analysis By Method EPA 200.8

**Matrix:** AQ **Batch ID:** MP26981

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA11951-1MS, DA11951-1MSD were used as the QC samples for the metals analysis.
- DA11888-1F and -5F for Cobalt: Elevated detection limit due to dilution required for possible matrix interference.

## General Chemistry By Method EPA 365.1

**Matrix:** AQ **Batch ID:** GP24264

- All samples were prepared and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA11888-3DUP, DA11936-1MS were used as the QC samples for the Phosphorus, Total analysis.

## General Chemistry By Method EPA300.0/SW846 9056A

**Matrix:** AQ **Batch ID:** GP24222

- All samples were prepared and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA11837-2MS, DA11837-2MSD were used as the QC samples for the Chloride, Nitrogen, Nitrate, Sulfate, Chloride analysis.

## General Chemistry By Method SM 2320B-2011

**Matrix:** AQ **Batch ID:** GN45605

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA11828-2MS, DA11828-2MSD, DA11850-1DUP were used as the QC samples for the Alkalinity, Total as CaCO3 analysis.

## General Chemistry By Method SM 2540C-2011

**Matrix:** AQ **Batch ID:** GN45505

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA11816-1DUP were used as the QC samples for the Solids, Total Dissolved analysis.

SGS certifies that data reported for samples received, listed on the associated custody chain or analytical task order, were produced to specifications meeting SGS's Quality System precision, accuracy and completeness objectives except as noted.

Estimated non-standard method measurement uncertainty data is available on request, based on quality control bias and implicit for standard methods. Acceptable uncertainty requires tested parameter quality control data to meet method criteria.

SGS is not responsible for data quality assumptions if partial reports are used and recommends that this report be used in its entirety. This report is authorized by SGS indicated via signature on the report cover.

# Summary of Hits

**Job Number:** DA11888
**Account:** ERM-West, Inc.
**Project:** Parkdale Quarry GW
**Collected:** 12/11/18 thru 12/12/18

| Lab Sample ID<br>Analyte | Client Sample ID | Result/<br>Qual | RL | MDL | Units | Method |
|---|---|---|---|---|---|---|
| **DA11888-1** | **WELL 1:PARKDALE** | | | | | |
| Alkalinity, Total as CaCO3 | | 190 | 5.0 | | mg/l | SM 2320B-2011 |
| Chloride | | 8.0 | 2.5 | | mg/l | EPA300.0/SW846 9056A |
| Nitrogen, Nitrate | | 5.7 | 0.25 | | mg/l | EPA300.0/SW846 9056A |
| Phosphorus, Total | | 0.28 | 0.010 | | mg/l | EPA 365.1 |
| Solids, Total Dissolved | | 406 | 10 | | mg/l | SM 2540C-2011 |
| Sulfate | | 99.0 | 2.5 | | mg/l | EPA300.0/SW846 9056A |
| **DA11888-1F** | **WELL 1:PARKDALE** | | | | | |
| Barium | | 18.3 | 4.0 | | ug/l | EPA 200.8 |
| Calcium | | 67600 | 800 | | ug/l | EPA 200.8 |
| Iron | | 179 | 20 | | ug/l | EPA 200.8 |
| Magnesium | | 15800 | 200 | | ug/l | EPA 200.8 |
| Manganese | | 5.0 | 2.0 | | ug/l | EPA 200.8 |
| Molybdenum | | 40.0 | 2.0 | | ug/l | EPA 200.8 |
| Nickel | | 5.2 | 4.0 | | ug/l | EPA 200.8 |
| Potassium | | 2900 | 400 | | ug/l | EPA 200.8 |
| Selenium | | 2.9 | 0.80 | | ug/l | EPA 200.8 |
| Silicon | | 7660 | 1000 | | ug/l | EPA 200.7 |
| Sodium | | 23700 | 1000 | | ug/l | EPA 200.8 |
| Uranium | | 17.3 | 0.40 | | ug/l | EPA 200.8 |
| **DA11888-3** | **WELL 3:PARKDALE** | | | | | |
| Alkalinity, Total as CaCO3 | | 176 | 5.0 | | mg/l | SM 2320B-2011 |
| Chloride | | 11.6 | 2.5 | | mg/l | EPA300.0/SW846 9056A |
| Nitrogen, Nitrate | | 1.9 | 0.050 | | mg/l | EPA300.0/SW846 9056A |
| Phosphorus, Total | | 0.98 | 0.010 | | mg/l | EPA 365.1 |
| Solids, Total Dissolved | | 338 | 10 | | mg/l | SM 2540C-2011 |
| Sulfate | | 63.2 | 2.5 | | mg/l | EPA300.0/SW846 9056A |
| **DA11888-3F** | **WELL 3:PARKDALE** | | | | | |
| Arsenic | | 0.59 | 0.40 | | ug/l | EPA 200.8 |
| Barium | | 31.4 | 4.0 | | ug/l | EPA 200.8 |
| Calcium | | 50200 | 800 | | ug/l | EPA 200.8 |
| Iron | | 139 | 20 | | ug/l | EPA 200.8 |
| Magnesium | | 11400 | 200 | | ug/l | EPA 200.8 |
| Manganese | | 9.8 | 2.0 | | ug/l | EPA 200.8 |
| Molybdenum | | 141 | 2.0 | | ug/l | EPA 200.8 |
| Potassium | | 2360 | 400 | | ug/l | EPA 200.8 |
| Selenium | | 3.2 | 0.80 | | ug/l | EPA 200.8 |
| Silicon | | 9950 | 50 | | ug/l | EPA 200.7 |

# Summary of Hits

**Job Number:** DA11888
**Account:** ERM-West, Inc.
**Project:** Parkdale Quarry GW
**Collected:** 12/11/18 thru 12/12/18

| Lab Sample ID<br>Analyte | Client Sample ID | Result/<br>Qual | RL | MDL | Units | Method |
|---|---|---|---|---|---|---|
| Sodium | | 30700 | 1000 | | ug/l | EPA 200.8 |
| Uranium | | 21.2 | 0.40 | | ug/l | EPA 200.8 |
| **DA11888-5** | **WELL 10:PARKDALE** | | | | | |
| Alkalinity, Total as CaCO3 | | 253 | 5.0 | | mg/l | SM 2320B-2011 |
| Chloride | | 8.0 | 2.5 | | mg/l | EPA300.0/SW846 9056A |
| Nitrogen, Nitrate | | 0.12 | 0.050 | | mg/l | EPA300.0/SW846 9056A |
| Phosphorus, Total | | 3.1 | 0.10 | | mg/l | EPA 365.1 |
| Solids, Total Dissolved | | 437 | 10 | | mg/l | SM 2540C-2011 |
| Sulfate | | 86.3 | 2.5 | | mg/l | EPA300.0/SW846 9056A |
| **DA11888-5F** | **WELL 10:PARKDALE** | | | | | |
| Arsenic | | 0.42 | 0.40 | | ug/l | EPA 200.8 |
| Barium | | 39.1 | 4.0 | | ug/l | EPA 200.8 |
| Calcium | | 81400 | 800 | | ug/l | EPA 200.8 |
| Copper | | 8.4 | 4.0 | | ug/l | EPA 200.8 |
| Iron | | 221 | 20 | | ug/l | EPA 200.8 |
| Magnesium | | 16500 | 200 | | ug/l | EPA 200.8 |
| Manganese | | 24.1 | 2.0 | | ug/l | EPA 200.8 |
| Molybdenum | | 38.3 | 2.0 | | ug/l | EPA 200.8 |
| Nickel | | 10.2 | 4.0 | | ug/l | EPA 200.8 |
| Potassium | | 2550 | 400 | | ug/l | EPA 200.8 |
| Selenium | | 1.2 | 0.80 | | ug/l | EPA 200.8 |
| Silicon | | 13000 | 50 | | ug/l | EPA 200.7 |
| Sodium | | 22600 | 1000 | | ug/l | EPA 200.8 |
| Uranium | | 38.2 | 0.40 | | ug/l | EPA 200.8 |

## Sample Results

## Report of Analysis

# Report of Analysis

| | | | |
|---|---|---|---|
| **Client Sample ID:** | WELL 1:PARKDALE | | |
| **Lab Sample ID:** | DA11888-1 | **Date Sampled:** | 12/11/18 |
| **Matrix:** | AQ - Ground Water | **Date Received:** | 12/12/18 |
| | | **Percent Solids:** | n/a |
| **Project:** | Parkdale Quarry GW | | |

## General Chemistry

| Analyte | Result | RL | Units | DF | Analyzed | By | Method |
|---|---|---|---|---|---|---|---|
| Alkalinity, Total as CaCO3 | 190 | 5.0 | mg/l | 1 | 12/24/18 10:00 | PV | SM 2320B-2011 |
| Chloride | 8.0 | 2.5 | mg/l | 5 | 12/13/18 09:37 | MA | EPA300.0/SW846 9056A |
| Nitrogen, Nitrate | 5.7 | 0.25 | mg/l | 25 | 12/13/18 10:16 | MA | EPA300.0/SW846 9056A |
| Phosphorus, Total | 0.28 | 0.010 | mg/l | 1 | 12/19/18 16:13 | AM | EPA 365.1 |
| Solids, Total Dissolved | 406 | 10 | mg/l | 1 | 12/17/18 | JD | SM 2540C-2011 |
| Sulfate | 99.0 | 2.5 | mg/l | 5 | 12/13/18 09:37 | MA | EPA300.0/SW846 9056A |

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RL = Reporting Limit

SGS North America Inc.

# Report of Analysis

Page 1 of 1

**Client Sample ID:** WELL 1:PARKDALE
**Lab Sample ID:** DA11888-1F
**Matrix:** AQ - Groundwater Filtered
**Date Sampled:** 12/11/18
**Date Received:** 12/12/18
**Percent Solids:** n/a
**Project:** Parkdale Quarry GW

## Dissolved Metals Analysis

| Analyte | Result | RL | Units | DF | Prep | Analyzed By | | Method | Prep Method |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | < 100 | 100 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Antimony | < 0.80 | 0.80 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [1] | EPA 200.8 [6] |
| Arsenic | < 0.40 | 0.40 | ug/l | 2 | 12/18/18 | 12/24/18 | JM | EPA 200.8 [4] | EPA 200.8 [6] |
| Barium | 18.3 | 4.0 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Cadmium | < 0.20 | 0.20 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Calcium | 67600 | 800 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Chromium | < 4.0 | 4.0 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Cobalt [a] | < 2.0 | 2.0 | ug/l | 10 | 12/18/18 | 12/24/18 | JM | EPA 200.8 [4] | EPA 200.8 [6] |
| Copper | < 4.0 | 4.0 | ug/l | 2 | 12/18/18 | 12/24/18 | JM | EPA 200.8 [4] | EPA 200.8 [6] |
| Iron | 179 | 20 | ug/l | 2 | 12/18/18 | 12/24/18 | JM | EPA 200.8 [4] | EPA 200.8 [6] |
| Lead | < 1.0 | 1.0 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Magnesium | 15800 | 200 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Manganese | 5.0 | 2.0 | ug/l | 2 | 12/18/18 | 12/24/18 | JM | EPA 200.8 [4] | EPA 200.8 [6] |
| Molybdenum | 40.0 | 2.0 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Nickel | 5.2 | 4.0 | ug/l | 2 | 12/18/18 | 12/24/18 | JM | EPA 200.8 [4] | EPA 200.8 [6] |
| Potassium | 2900 | 400 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Selenium | 2.9 | 0.80 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Silicon | 7660 | 1000 | ug/l | 20 | 12/14/18 | 12/21/18 | JR | EPA 200.7 [2] | EPA 200.7 [5] |
| Sodium | 23700 | 1000 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Uranium | 17.3 | 0.40 | ug/l | 2 | 12/18/18 | 12/24/18 | JM | EPA 200.8 [4] | EPA 200.8 [6] |
| Zinc | < 20 | 20 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |

(1) Instrument QC Batch: MA10823
(2) Instrument QC Batch: MA10829
(3) Instrument QC Batch: MA10831
(4) Instrument QC Batch: MA10837
(5) Prep QC Batch: MP26974
(6) Prep QC Batch: MP26981

(a) Elevated detection limit due to dilution required for possible matrix interference.

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RL = Reporting Limit

# Report of Analysis

| | | | |
|---|---|---|---|
| **Client Sample ID:** | WELL 3:PARKDALE | | |
| **Lab Sample ID:** | DA11888-3 | **Date Sampled:** | 12/11/18 |
| **Matrix:** | AQ - Ground Water | **Date Received:** | 12/12/18 |
| | | **Percent Solids:** | n/a |
| **Project:** | Parkdale Quarry GW | | |

## General Chemistry

| Analyte | Result | RL | Units | DF | Analyzed | By | Method |
|---|---|---|---|---|---|---|---|
| Alkalinity, Total as CaCO3 | 176 | 5.0 | mg/l | 1 | 12/24/18 10:00 | PV | SM 2320B-2011 |
| Chloride | 11.6 | 2.5 | mg/l | 5 | 12/13/18 09:50 | MA | EPA300.0/SW846 9056A |
| Nitrogen, Nitrate | 1.9 | 0.050 | mg/l | 5 | 12/13/18 09:50 | MA | EPA300.0/SW846 9056A |
| Phosphorus, Total | 0.98 | 0.010 | mg/l | 1 | 12/19/18 16:14 | AM | EPA 365.1 |
| Solids, Total Dissolved | 338 | 10 | mg/l | 1 | 12/17/18 | JD | SM 2540C-2011 |
| Sulfate | 63.2 | 2.5 | mg/l | 5 | 12/13/18 09:50 | MA | EPA300.0/SW846 9056A |

RL = Reporting Limit

# Report of Analysis

**Client Sample ID:** WELL 3:PARKDALE
**Lab Sample ID:** DA11888-3F
**Matrix:** AQ - Groundwater Filtered
**Date Sampled:** 12/11/18
**Date Received:** 12/12/18
**Percent Solids:** n/a

**Project:** Parkdale Quarry GW

## Dissolved Metals Analysis

| Analyte | Result | RL | Units | DF | Prep | Analyzed | By | Method | Prep Method |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | < 100 | 100 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Antimony | < 0.80 | 0.80 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [1] | EPA 200.8 [6] |
| Arsenic | 0.59 | 0.40 | ug/l | 2 | 12/18/18 | 12/24/18 | JM | EPA 200.8 [4] | EPA 200.8 [6] |
| Barium | 31.4 | 4.0 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Cadmium | < 0.20 | 0.20 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Calcium | 50200 | 800 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Chromium | < 4.0 | 4.0 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Cobalt | < 0.40 | 0.40 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Copper | < 4.0 | 4.0 | ug/l | 2 | 12/18/18 | 12/24/18 | JM | EPA 200.8 [4] | EPA 200.8 [6] |
| Iron | 139 | 20 | ug/l | 2 | 12/18/18 | 12/24/18 | JM | EPA 200.8 [4] | EPA 200.8 [6] |
| Lead | < 1.0 | 1.0 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Magnesium | 11400 | 200 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Manganese | 9.8 | 2.0 | ug/l | 2 | 12/18/18 | 12/24/18 | JM | EPA 200.8 [4] | EPA 200.8 [6] |
| Molybdenum | 141 | 2.0 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Nickel | < 4.0 | 4.0 | ug/l | 2 | 12/18/18 | 12/24/18 | JM | EPA 200.8 [4] | EPA 200.8 [6] |
| Potassium | 2360 | 400 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Selenium | 3.2 | 0.80 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Silicon | 9950 | 50 | ug/l | 1 | 12/14/18 | 12/21/18 | JR | EPA 200.7 [2] | EPA 200.7 [5] |
| Sodium | 30700 | 1000 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Uranium | 21.2 | 0.40 | ug/l | 2 | 12/18/18 | 12/24/18 | JM | EPA 200.8 [4] | EPA 200.8 [6] |
| Zinc | < 20 | 20 | ug/l | 2 | 12/18/18 | 12/21/18 | JM | EPA 200.8 [3] | EPA 200.8 [6] |

(1) Instrument QC Batch: MA10823
(2) Instrument QC Batch: MA10829
(3) Instrument QC Batch: MA10831
(4) Instrument QC Batch: MA10837
(5) Prep QC Batch: MP26974
(6) Prep QC Batch: MP26981

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RL = Reporting Limit

# Report of Analysis

| | | | |
|---|---|---|---|
| **Client Sample ID:** | WELL 10:PARKDALE | | |
| **Lab Sample ID:** | DA11888-5 | **Date Sampled:** | 12/12/18 |
| **Matrix:** | AQ - Ground Water | **Date Received:** | 12/12/18 |
| | | **Percent Solids:** | n/a |
| **Project:** | Parkdale Quarry GW | | |

## General Chemistry

| Analyte | Result | RL | Units | DF | Analyzed | By | Method |
|---|---|---|---|---|---|---|---|
| Alkalinity, Total as CaCO3 | 253 | 5.0 | mg/l | 1 | 12/24/18 10:00 | PV | SM 2320B-2011 |
| Chloride | 8.0 | 2.5 | mg/l | 5 | 12/13/18 10:03 | MA | EPA300.0/SW846 9056A |
| Nitrogen, Nitrate | 0.12 | 0.050 | mg/l | 5 | 12/13/18 10:03 | MA | EPA300.0/SW846 9056A |
| Phosphorus, Total | 3.1 | 0.10 | mg/l | 10 | 12/19/18 16:48 | AM | EPA 365.1 |
| Solids, Total Dissolved | 437 | 10 | mg/l | 1 | 12/17/18 | JD | SM 2540C-2011 |
| Sulfate | 86.3 | 2.5 | mg/l | 5 | 12/13/18 10:03 | MA | EPA300.0/SW846 9056A |

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RL = Reporting Limit

# Report of Analysis

**Client Sample ID:** WELL 10:PARKDALE
**Lab Sample ID:** DA11888-5F
**Matrix:** AQ - Groundwater Filtered
**Date Sampled:** 12/12/18
**Date Received:** 12/12/18
**Percent Solids:** n/a
**Project:** Parkdale Quarry GW

## Dissolved Metals Analysis

| Analyte | Result | RL | Units | DF | Prep | Analyzed By | Method | Prep Method |
|---|---|---|---|---|---|---|---|---|
| Aluminum | < 100 | 100 | ug/l | 2 | 12/18/18 | 12/21/18 JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Antimony | < 0.80 | 0.80 | ug/l | 2 | 12/18/18 | 12/21/18 JM | EPA 200.8 [1] | EPA 200.8 [6] |
| Arsenic | 0.42 | 0.40 | ug/l | 2 | 12/18/18 | 12/24/18 JM | EPA 200.8 [4] | EPA 200.8 [6] |
| Barium | 39.1 | 4.0 | ug/l | 2 | 12/18/18 | 12/21/18 JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Cadmium | < 0.20 | 0.20 | ug/l | 2 | 12/18/18 | 12/21/18 JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Calcium | 81400 | 800 | ug/l | 2 | 12/18/18 | 12/21/18 JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Chromium | < 4.0 | 4.0 | ug/l | 2 | 12/18/18 | 12/21/18 JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Cobalt [a] | < 2.0 | 2.0 | ug/l | 10 | 12/18/18 | 12/24/18 JM | EPA 200.8 [4] | EPA 200.8 [6] |
| Copper | 8.4 | 4.0 | ug/l | 2 | 12/18/18 | 12/24/18 JM | EPA 200.8 [4] | EPA 200.8 [6] |
| Iron | 221 | 20 | ug/l | 2 | 12/18/18 | 12/24/18 JM | EPA 200.8 [4] | EPA 200.8 [6] |
| Lead | < 1.0 | 1.0 | ug/l | 2 | 12/18/18 | 12/21/18 JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Magnesium | 16500 | 200 | ug/l | 2 | 12/18/18 | 12/21/18 JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Manganese | 24.1 | 2.0 | ug/l | 2 | 12/18/18 | 12/24/18 JM | EPA 200.8 [4] | EPA 200.8 [6] |
| Molybdenum | 38.3 | 2.0 | ug/l | 2 | 12/18/18 | 12/21/18 JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Nickel | 10.2 | 4.0 | ug/l | 2 | 12/18/18 | 12/24/18 JM | EPA 200.8 [4] | EPA 200.8 [6] |
| Potassium | 2550 | 400 | ug/l | 2 | 12/18/18 | 12/21/18 JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Selenium | 1.2 | 0.80 | ug/l | 2 | 12/18/18 | 12/21/18 JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Silicon | 13000 | 50 | ug/l | 1 | 12/14/18 | 12/21/18 JR | EPA 200.7 [2] | EPA 200.7 [5] |
| Sodium | 22600 | 1000 | ug/l | 2 | 12/18/18 | 12/21/18 JM | EPA 200.8 [3] | EPA 200.8 [6] |
| Uranium | 38.2 | 0.40 | ug/l | 2 | 12/18/18 | 12/24/18 JM | EPA 200.8 [4] | EPA 200.8 [6] |
| Zinc | < 20 | 20 | ug/l | 2 | 12/18/18 | 12/21/18 JM | EPA 200.8 [3] | EPA 200.8 [6] |

(1) Instrument QC Batch: MA10823
(2) Instrument QC Batch: MA10829
(3) Instrument QC Batch: MA10831
(4) Instrument QC Batch: MA10837
(5) Prep QC Batch: MP26974
(6) Prep QC Batch: MP26981

(a) Elevated detection limit due to dilution required for possible matrix interference.

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RL = Reporting Limit

# Misc. Forms

## Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

# CHAIN OF ~~CUSTODY~~

4036 Youngfield Street, Wheat Ridge, CO 80033
TEL: 303-425-6021 FAX: 303-425-6854
www.accutest.com

Page ___ of ___

| | |
|---|---|
| Bottle Order Control # | FED-EX Tracking # |
| SGS Quote # | **SGS Job #** DA11888 |

| **Client / Reporting Information** | **Project Information** | |
|---|---|---|
| Company: ERM-West, Inc. | Project Name: Parkdale Quarry GW | |
| Street: 555 17th St, #1700 | Street: | **Billing Information (if different from Report to)** |
| City, State: Denver, CO | City, State: | Company: ermwest accountsreceivable |
| Project Contact: Zach Walker | Project #: 0488586 | Street Address: @erm.com |
| Phone: 303-741-5050<br>Email: zack.walker@erm.com | Client Purchase Order #: | City, State ZIP: |
| Sampler(s) Name(s): Z.Walker, P. Mehring | Project Manager: Becky Moore | Attention: |

**Requested Analysis (see TEST CODE sheet)**

| Field ID / Point of Collection | Collection Date | Collection Time | Sampled by | Matrix | # of bottles | NONE | HCl | NaOH | HNO3 | H2SO4 | DI Water | MEOH | ENCORE | Na2S2O3 | Na2SO3 | Alkalinity (SM 2320B-2011) | Dissolved Metals LF (EPA 200.8) | SO4, NO3O, CHL (EPA 300.0) | TDS (SM 4500-PE-2011) | Total PO4 (SM 4500-P E-2011) | Isotopic Uranium | Gross Alpha/Beta + total | Radium 226 | Radium 228 | LAB USE ONLY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Well 1: Parkdale | 12/11/18 | 11:28 | PM | GW | 12 | 5 | | | 6 | 1 | | | | | | X | X | X | X | X | X | X | X | X | 01 |
| Well 1: Parkdale Dup | 12/11/18 | 11:28 | | | 12 | 5 | | | 6 | 1 | | | | | | HOLD PENDING ANALSIS | | | | | | | | | 02 |
| Well 3 Parkdale | 12/11/18 | 15:35 | | | 12 | 5 | | | 6 | 1 | | | | | | X | X | X | X | X | X | X | X | X | 03 |
| Well 3 Parkdale Dup | 12/11/18 | 15:35 | | | 12 | 5 | | | 6 | 1 | | | | | | HOLD | | | | | | | | | 04 |
| Well 10 Parkdale | 12/12/18 | 10:52 | | | 12 | 5 | | | 6 | 1 | | | | | | X | X | X | X | X | X | X | X | X | 05 |
| Well 10 Parkdale Dup | 12/12/18 | 10:52 | ↓ | ↓ | 12 | 5 | | | 6 | 1 | | | | | | HOLD | | | | | | | | | 06 |

**Matrix Codes**
DW - Drinking Water
GW - Ground Water
WW - Water
SW - Surface Water
SO - Soil
SL- Sludge
SED-Sediment
OI - Oil
LIQ - Other Liquid
AIR - Air
SOL - Other Solid
WP - Wipe
FB-Field Blank
EB-Equipment Blank
RB- Rinse Blank
TB-Trip Blank

**Turnaround Time (Business days)**

☒ Std. 10 Business Days
☐ 5 Day RUSH
☐ 3 Day Emergency
☐ 2 Day Emergency
☐ 1 Day Emergency

Special Reporting Instructions
☐ Report in PPB
☐ Report in PPM
☐ Report MDLs

Emergency & Rush T/A data available VIA LabLink. RUSH TAT approval needed.

**Data Deliverable Information**

☐ Commercial "A" (Level 1, Results Only)
☒ Commercial "B" (Level 2, Results + QC Summary)
☐ COMMBN (Results/QC/Narrative)
☐ COMMBN+ [Results/QC/Narrative (+ chromatograms)]
☐ REDT2
☐ FULT1
☐ EDD Format ___________

**Comments / Special Instructions**

**Sample Custody must be documented below each time samples change possession, including courier delivery.**

| | | | | | |
|---|---|---|---|---|---|
| Relinquished by Sampler:<br>1 | Date/Time:<br>12/12/18 1705 | Received By:<br>1 | Relinquished By:<br>2 | Date/Time: | Received By:<br>2 |
| Relinquished by Sampler:<br>3 | Date/Time: | Received By:<br>3 | Relinquished By:<br>4 | Date/Time: | Received By:<br>4 |

Custody Seal # Intact ☑ Not intact ☐ Absent ☐
Preserved where applicable ☑ HIO
Cooler Temp. °C: 1.1
Therm. ID: T18C
On Ice ☑

Form MSQA 064-01, RV 6/19/17
http://www.sgs.com/terms-and-conditions

# SGS Accutest Sample Receipt Summary

**Job Number:** DA11888 **Client:** ERM **Project:** PARKDALE

**Date / Time Received:** 12/12/2018 5:05:00 PM **Delivery Method:** **Airbill #'s:** HD

**Cooler Temps (Initial/Adjusted):** #1: (1.1/1.1);

| **Cooler Security** | **Y** | **N** | | **Y** | **N** |
|---|---|---|---|---|---|
| 1. Custody Seals Present: | ☑ | ☐ | 3. COC Present: | ☑ | ☐ |
| 2. Custody Seals Intact: | ☑ | ☐ | 4. Smpl Dates/Time OK | ☑ | ☐ |

| **Cooler Temperature** | **Y** | **N** |
|---|---|---|
| 1. Temp criteria achieved: | ☑ | ☐ |
| 2. Cooler temp verification: | Bar Therm; | |
| 3. Cooler media: | Ice (Bag) | |
| 4. No. Coolers: | 1 | |

| **Quality Control Preservation** | **Y** | **N** | **N/A** |
|---|---|---|---|
| 1. Trip Blank present / cooler: | ☐ | ☐ | ☑ |
| 2. Trip Blank listed on COC: | ☐ | ☐ | ☑ |
| 3. Samples preserved properly: | ☑ | ☐ | |
| 4. VOCs headspace free: | ☐ | ☐ | ☑ |

| **Sample Integrity - Documentation** | **Y** | **N** |
|---|---|---|
| 1. Sample labels present on bottles: | ☑ | ☐ |
| 2. Container labeling complete: | ☑ | ☐ |
| 3. Sample container label / COC agree: | ☑ | ☐ |

| **Sample Integrity - Condition** | **Y** | **N** |
|---|---|---|
| 1. Sample recvd within HT: | ☑ | ☐ |
| 2. All containers accounted for: | ☑ | ☐ |
| 3. Condition of sample: | Intact | |

| **Sample Integrity - Instructions** | **Y** | **N** | **N/A** |
|---|---|---|---|
| 1. Analysis requested is clear: | ☑ | ☐ | |
| 2. Bottles received for unspecified tests | ☐ | ☑ | |
| 3. Sufficient volume recvd for analysis: | ☑ | ☐ | |
| 4. Compositing instructions clear: | ☐ | ☐ | ☑ |
| 5. Filtering instructions clear: | ☐ | ☐ | ☑ |

Comments

## Metals Analysis

## QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Matrix Spike and Duplicate Summaries
- Blank Spike and Lab Control Sample Summaries
- Serial Dilution Summaries

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: DA11888
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP26974
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 12/14/18

| Metal | RL | IDL | MDL | MB raw | final |
|---|---|---|---|---|---|
| Aluminum | 100 | 46 | 46 | | |
| Antimony | 30 | 14 | 8.7 | | |
| Arsenic | 25 | 22 | 12 | | |
| Barium | 10 | .3 | .2 | | |
| Beryllium | 10 | 1 | 1.6 | | |
| Boron | 50 | 3.3 | 3.7 | | |
| Cadmium | 10 | 1.9 | .6 | | |
| Calcium | 400 | 6.6 | 22 | | |
| Chromium | 10 | 1.1 | 1 | | |
| Cobalt | 5.0 | 2.7 | 1.2 | | |
| Copper | 10 | 4.6 | 2.9 | | |
| Iron | 10 | 8.9 | 6.9 | | |
| Lead | 50 | 13 | 9.1 | | |
| Lithium | 5.0 | .6 | 1 | | |
| Magnesium | 200 | 50 | 39 | | |
| Manganese | 5.0 | .5 | .4 | | |
| Molybdenum | 10 | 8.5 | 3.6 | | |
| Nickel | 30 | 6.2 | 2.1 | | |
| Phosphorus | 100 | 91 | 47 | | |
| Potassium | 1000 | 84 | 61 | | |
| Selenium | 50 | 30 | 15 | | |
| Silicon | 50 | 41 | 6.2 | 52.7 | * (a) |
| Silver | 30 | .6 | .9 | | |
| Sodium | 400 | 13 | 14 | | |
| Strontium | 5.0 | .1 | .3 | | |
| Thallium | 10 | 17 | 9.1 | | |
| Tin | 50 | 41 | 25 | | |
| Titanium | 10 | .5 | 2.5 | | |
| Uranium | 50 | 3.9 | 4.4 | | |
| Vanadium | 10 | .9 | .6 | | |
| Zinc | 30 | 9 | 3.5 | | |

Associated samples MP26974: DA11888-1F, DA11888-3F, DA11888-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: DA11888
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP26974
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 12/14/18

| Metal | RL | IDL | MDL | MB raw | final |
|---|---|---|---|---|---|

(anr) Analyte not requested
(a) All sample results >10x method blank concentration.

# MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA11888
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP26974
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 12/14/18

| Metal | DA11917-1<br>Original | MS | Spikelot<br>ICPALL2 | % Rec | QC<br>Limits |
|---|---|---|---|---|---|
| Aluminum | | | | | |
| Antimony | | | | | |
| Arsenic | | | | | |
| Barium | | | | | |
| Beryllium | | | | | |
| Boron | | | | | |
| Cadmium | | | | | |
| Calcium | anr | | | | |
| Chromium | anr | | | | |
| Cobalt | | | | | |
| Copper | anr | | | | |
| Iron | anr | | | | |
| Lead | anr | | | | |
| Lithium | | | | | |
| Magnesium | anr | | | | |
| Manganese | anr | | | | |
| Molybdenum | anr | | | | |
| Nickel | anr | | | | |
| Phosphorus | anr | | | | |
| Potassium | anr | | | | |
| Selenium | | | | | |
| Silicon | 185 | 1300 | 1000 | 130.0 | 70-130 |
| Silver | | | | | |
| Sodium | anr | | | | |
| Strontium | | | | | |
| Thallium | | | | | |
| Tin | | | | | |
| Titanium | | | | | |
| Uranium | | | | | |
| Vanadium | | | | | |
| Zinc | anr | | | | |

Associated samples MP26974: DA11888-1F, DA11888-3F, DA11888-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

# MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA11888
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP26974
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 12/14/18

| Metal | DA11917-1 Original MS | Spikelot ICPALL2 | % Rec | QC Limits |
|---|---|---|---|---|

(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested

# MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA11888
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP26974
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 12/14/18

| Metal | DA11917-1 Original | MSD | Spikelot ICPALL2 | % Rec | MSD RPD | QC Limit |
|---|---|---|---|---|---|---|
| Aluminum | | | | | | |
| Antimony | | | | | | |
| Arsenic | | | | | | |
| Barium | | | | | | |
| Beryllium | | | | | | |
| Boron | | | | | | |
| Cadmium | | | | | | |
| Calcium | anr | | | | | |
| Chromium | anr | | | | | |
| Cobalt | | | | | | |
| Copper | anr | | | | | |
| Iron | anr | | | | | |
| Lead | anr | | | | | |
| Lithium | | | | | | |
| Magnesium | anr | | | | | |
| Manganese | anr | | | | | |
| Molybdenum | anr | | | | | |
| Nickel | anr | | | | | |
| Phosphorus | anr | | | | | |
| Potassium | anr | | | | | |
| Selenium | | | | | | |
| Silicon | 185 | 1280 | 1000 | 109.5 | 1.6 | 20 |
| Silver | | | | | | |
| Sodium | anr | | | | | |
| Strontium | | | | | | |
| Thallium | | | | | | |
| Tin | | | | | | |
| Titanium | | | | | | |
| Uranium | | | | | | |
| Vanadium | | | | | | |
| Zinc | anr | | | | | |

Associated samples MP26974: DA11888-1F, DA11888-3F, DA11888-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

## MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA11888
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP26974
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 12/14/18

| Metal | DA11917-1 Original | MSD | Spikelot ICPALL2 | % Rec | MSD RPD | QC Limit |
|---|---|---|---|---|---|---|

(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested

# SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: DA11888
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP26974
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 12/14/18

| Metal | BSP Result | Spikelot ICPALL2 | % Rec | QC Limits |
|---|---|---|---|---|
| Aluminum | | | | |
| Antimony | | | | |
| Arsenic | | | | |
| Barium | | | | |
| Beryllium | | | | |
| Boron | | | | |
| Cadmium | | | | |
| Calcium | anr | | | |
| Chromium | anr | | | |
| Cobalt | | | | |
| Copper | anr | | | |
| Iron | anr | | | |
| Lead | anr | | | |
| Lithium | | | | |
| Magnesium | anr | | | |
| Manganese | anr | | | |
| Molybdenum | anr | | | |
| Nickel | anr | | | |
| Phosphorus | anr | | | |
| Potassium | anr | | | |
| Selenium | | | | |
| Silicon | 1090 | 1000 | 109.0 | 85-115 |
| Silver | | | | |
| Sodium | anr | | | |
| Strontium | | | | |
| Thallium | | | | |
| Tin | | | | |
| Titanium | | | | |
| Uranium | | | | |
| Vanadium | | | | |
| Zinc | anr | | | |

Associated samples MP26974: DA11888-1F, DA11888-3F, DA11888-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: DA11888
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP26974
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 12/14/18

| Metal | BSP Result | Spikelot ICPALL2 | % Rec | QC Limits |
|---|---|---|---|---|

(anr) Analyte not requested

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: DA11888
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP26981
Matrix Type: AQUEOUS

Methods: EPA 200.8
Units: ug/l

Prep Date: 12/18/18

| Metal | RL | IDL | MDL | MB raw | final |
|---|---|---|---|---|---|
| Aluminum | 50 | 1.1 | 2 | 4.6 | <50 |
| Antimony | 0.40 | .0022 | .011 | 0.0070 | <0.40 |
| Arsenic | 0.20 | .017 | .044 | -0.0050 | <0.20 |
| Barium | 2.0 | .016 | .079 | 0.039 | <2.0 |
| Beryllium | 0.20 | .016 | .069 | | |
| Boron | 40 | .49 | 2.1 | | |
| Cadmium | 0.10 | .036 | .042 | 0.045 | <0.10 |
| Calcium | 400 | 5.6 | 12 | -1.7 | <400 |
| Chromium | 2.0 | .053 | .053 | -0.45 | <2.0 |
| Cobalt | 0.20 | .0049 | .015 | -0.0010 | <0.20 |
| Copper | 2.0 | .06 | .13 | 0.043 | <2.0 |
| Iron | 10 | 3.5 | 4.6 | 1.4 | <10 |
| Lead | 0.50 | .0079 | .008 | -0.0010 | <0.50 |
| Magnesium | 100 | 1.3 | 1.3 | 9.2 | <100 |
| Manganese | 1.0 | .12 | .13 | 0.23 | <1.0 |
| Molybdenum | 1.0 | .049 | .029 | 0.0 | <1.0 |
| Nickel | 2.0 | .0088 | .027 | 0.013 | <2.0 |
| Phosphorus | 60 | 2.6 | 4.3 | | |
| Potassium | 200 | 2.9 | 2.9 | -17 | <200 |
| Selenium | 0.40 | .06 | .21 | -0.076 | <0.40 |
| Silver | 0.10 | .0019 | .008 | | |
| Sodium | 500 | 4.9 | 4.9 | 13.9 | <500 |
| Strontium | 20 | .01 | .015 | | |
| Thallium | 0.20 | .0024 | .005 | | |
| Tin | 10 | .063 | 1.3 | | |
| Titanium | 2.0 | .059 | .092 | | |
| Uranium | 0.20 | .0017 | .002 | 0.0070 | <0.20 |
| Vanadium | 1.0 | .037 | .2 | | |
| Zinc | 10 | .21 | .96 | 1.2 | <10 |

Associated samples MP26981: DA11888-1F, DA11888-3F, DA11888-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

# MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA11888
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP26981
Matrix Type: AQUEOUS

Methods: EPA 200.8
Units: ug/l

Prep Date: 12/18/18

| Metal | DA11951-1 Original | MS | Spikelot ICPALL2 | % Rec | QC Limits |
|---|---|---|---|---|---|
| Aluminum | 12.1 | 1010 | 1000 | 99.8 | 70-130 |
| Antimony | 0.18 | 108 | 100 | 107.8 | 70-130 |
| Arsenic | 0.12 | 209 | 200 | 104.4 | 70-130 |
| Barium | 24.2 | 400 | 400 | 94.4 | 70-130 |
| Beryllium | | | | | |
| Boron | | | | | |
| Cadmium | 0.0 | 99.5 | 100 | 99.5 | 70-130 |
| Calcium | 15900 | 20200 | 5000 | 96.0 | 70-130 |
| Chromium | 0.0 | 101 | 100 | 101.0 | 70-130 |
| Cobalt | 0.0 | 95.7 | 100 | 95.7 | 70-130 |
| Copper | 0.43 | 106 | 100 | 105.6 | 70-130 |
| Iron | 47.2 | 1080 | 1000 | 103.3 | 70-130 |
| Lead | 0.12 | 213 | 200 | 106.4 | 70-130 |
| Magnesium | 2110 | 6900 | 5000 | 95.8 | 70-130 |
| Manganese | 6.0 | 113 | 100 | 107.0 | 70-130 |
| Molybdenum | 3.2 | 107 | 100 | 103.8 | 70-130 |
| Nickel | 0.56 | 106 | 100 | 105.4 | 70-130 |
| Phosphorus | | | | | |
| Potassium | 464 | 5210 | 5000 | 94.9 | 70-130 |
| Selenium | 0.0 | 191 | 200 | 95.5 | 70-130 |
| Silver | anr | | | | |
| Sodium | 1670 | 6160 | 5000 | 93.6 | 70-130 |
| Strontium | | | | | |
| Thallium | | | | | |
| Tin | | | | | |
| Titanium | | | | | |
| Uranium | 1.7 | 217 | 200 | 107.7 | 70-130 |
| Vanadium | | | | | |
| Zinc | 4.3 | 95.2 | 100 | 90.9 | 70-130 |

Associated samples MP26981: DA11888-1F, DA11888-3F, DA11888-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested

# MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA11888
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP26981
Matrix Type: AQUEOUS

Methods: EPA 200.8
Units: ug/l

Prep Date: 12/18/18

| Metal | DA11951-1 Original | MSD | Spikelot ICPALL2 | % Rec | MSD RPD | QC Limit |
|---|---|---|---|---|---|---|
| Aluminum | 12.1 | 988 | 1000 | 97.6 | 2.2 | 20 |
| Antimony | 0.18 | 106 | 100 | 105.8 | 1.9 | 20 |
| Arsenic | 0.12 | 209 | 200 | 104.4 | 0.0 | 20 |
| Barium | 24.2 | 393 | 400 | 92.6 | 1.8 | 20 |
| Beryllium | | | | | | |
| Boron | | | | | | |
| Cadmium | 0.0 | 98.5 | 100 | 98.5 | 1.0 | 20 |
| Calcium | 15900 | 19700 | 5000 | 86.0 | 2.5 | 20 |
| Chromium | 0.0 | 98.0 | 100 | 98.0 | 3.0 | 20 |
| Cobalt | 0.0 | 93.0 | 100 | 93.0 | 2.9 | 20 |
| Copper | 0.43 | 105 | 100 | 104.6 | 0.9 | 20 |
| Iron | 47.2 | 1080 | 1000 | 103.3 | 0.0 | 20 |
| Lead | 0.12 | 207 | 200 | 103.4 | 2.9 | 20 |
| Magnesium | 2110 | 6770 | 5000 | 93.2 | 1.9 | 20 |
| Manganese | 6.0 | 113 | 100 | 107.0 | 0.0 | 20 |
| Molybdenum | 3.2 | 105 | 100 | 101.8 | 1.9 | 20 |
| Nickel | 0.56 | 108 | 100 | 107.4 | 1.9 | 20 |
| Phosphorus | | | | | | |
| Potassium | 464 | 5180 | 5000 | 94.3 | 0.6 | 20 |
| Selenium | 0.0 | 189 | 200 | 94.5 | 1.1 | 20 |
| Silver | anr | | | | | |
| Sodium | 1670 | 6080 | 5000 | 92.0 | 1.3 | 20 |
| Strontium | | | | | | |
| Thallium | | | | | | |
| Tin | | | | | | |
| Titanium | | | | | | |
| Uranium | 1.7 | 215 | 200 | 106.7 | 0.9 | 20 |
| Vanadium | | | | | | |
| Zinc | 4.3 | 92.9 | 100 | 88.6 | 2.4 | 20 |

Associated samples MP26981: DA11888-1F, DA11888-3F, DA11888-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested

# SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: DA11888
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP26981
Matrix Type: AQUEOUS

Methods: EPA 200.8
Units: ug/l

Prep Date: 12/18/18

| Metal | BSP Result | Spikelot ICPALL2 | % Rec | QC Limits |
|---|---|---|---|---|
| Aluminum | 1010 | 1000 | 101.0 | 85-115 |
| Antimony | 107 | 100 | 107.0 | 85-115 |
| Arsenic | 208 | 200 | 104.0 | 85-115 |
| Barium | 377 | 400 | 94.3 | 85-115 |
| Beryllium | | | | |
| Boron | | | | |
| Cadmium | 99.4 | 100 | 99.4 | 85-115 |
| Calcium | 4990 | 5000 | 99.8 | 85-115 |
| Chromium | 101 | 100 | 101.0 | 85-115 |
| Cobalt | 95.9 | 100 | 95.9 | 85-115 |
| Copper | 104 | 100 | 104.0 | 85-115 |
| Iron | 1030 | 1000 | 103.0 | 85-115 |
| Lead | 212 | 200 | 106.0 | 85-115 |
| Magnesium | 4850 | 5000 | 97.0 | 85-115 |
| Manganese | 106 | 100 | 106.0 | 85-115 |
| Molybdenum | 103 | 100 | 103.0 | 85-115 |
| Nickel | 106 | 100 | 106.0 | 85-115 |
| Phosphorus | | | | |
| Potassium | 4780 | 5000 | 95.6 | 85-115 |
| Selenium | 191 | 200 | 95.5 | 85-115 |
| Silver | anr | | | |
| Sodium | 4820 | 5000 | 96.4 | 85-115 |
| Strontium | | | | |
| Thallium | | | | |
| Tin | | | | |
| Titanium | | | | |
| Uranium | 214 | 200 | 107.0 | 85-115 |
| Vanadium | | | | |
| Zinc | 92.0 | 100 | 92.0 | 85-115 |

Associated samples MP26981: DA11888-1F, DA11888-3F, DA11888-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

# Section 7

## General Chemistry

## QC Data Summaries

Includes the following where applicable:

- Method Blank and Blank Spike Summaries
- Duplicate Summaries
- Matrix Spike Summaries

# METHOD BLANK AND SPIKE RESULTS SUMMARY
## GENERAL CHEMISTRY

Login Number: DA11888
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

| Analyte | Batch ID | RL | MB Result | Units | Spike Amount | BSP Result | BSP %Recov | QC Limits |
|---|---|---|---|---|---|---|---|---|
| Alkalinity, Total as CaCO3 | GN45605 | 5.0 | 2.3 | mg/l | 100 | 97.5 | 97.5 | 90-110% |
| Alkalinity, Total as CaCO3 | GN45605 | 5.0 | 2.1 | mg/l | 100 | 97.4 | 97.4 | 90-110% |
| Bromide | GP24222/GN45485 | 0.050 | 0.0 | mg/l | 0.5 | 0.545 | 109.0 | 90-110% |
| Chloride | GP24222/GN45485 | 0.50 | 0.0 | mg/l | 5 | 5.47 | 109.4 | 90-110% |
| Fluoride | GP24222/GN45485 | 0.10 | 0.0 | mg/l | 1 | 1.09 | 109.0 | 90-110% |
| Nitrogen, Nitrate | GP24222/GN45485 | 0.010 | 0.0 | mg/l | 0.1 | 0.109 | 109.0 | 90-110% |
| Nitrogen, Nitrite | GP24222/GN45485 | 0.0040 | 0.0 | mg/l | 0.05 | 0.0508 | 101.6 | 90-110% |
| Phosphorus, Total | GP24264/GN45556 | 0.010 | 0.00 | mg/l | 0.2 | 0.187 | 93.5 | 90-110% |
| Phosphorus, Total | GP24264/GN45556 | 0.010 | 0.00 | mg/l | 0.2 | 0.194 | 97.0 | 90-110% |
| Solids, Total Dissolved | GN45505 | 10 | 0.0 | mg/l |  |  |  |  |
| Solids, Total Dissolved | GN45505 | 10 | 0.0 | mg/l | 400 | 396 | 99.0 | 90-110% |
| Sulfate | GP24222/GN45485 | 0.50 | 0.0 | mg/l | 5 | 5.42 | 108.4 | 90-110% |

Associated Samples:
Batch GN45505: DA11888-1, DA11888-3, DA11888-5
Batch GN45605: DA11888-1, DA11888-3, DA11888-5
Batch GP24222: DA11888-1, DA11888-3, DA11888-5
Batch GP24264: DA11888-1, DA11888-3, DA11888-5
(*) Outside of QC limits

## DUPLICATE RESULTS SUMMARY
## GENERAL CHEMISTRY

Login Number: DA11888
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

| Analyte | Batch ID | QC Sample | Units | Original Result | DUP Result | RPD | QC Limits |
|---|---|---|---|---|---|---|---|
| Alkalinity, Total as CaCO3 | GN45605 | DA11850-1 | mg/l | 208 | 211 | 1.4 | 0-20% |
| Phosphorus, Total | GP24264/GN45556 | DA11888-3 | mg/l | 0.98 | 0.967 | 1.0 | 0-20% |
| Solids, Total Dissolved | GN45505 | DA11816-1 | mg/l | 438 | 447 | 2.0 | 0-5% |

Associated Samples:
Batch GN45505: DA11888-1, DA11888-3, DA11888-5
Batch GN45605: DA11888-1, DA11888-3, DA11888-5
Batch GP24264: DA11888-1, DA11888-3, DA11888-5
(*) Outside of QC limits

# MATRIX SPIKE RESULTS SUMMARY
# GENERAL CHEMISTRY

Login Number: DA11888
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

| Analyte | Batch ID | QC Sample | Units | Original Result | Spike Amount | MS Result | %Rec | QC Limits |
|---|---|---|---|---|---|---|---|---|
| Alkalinity, Total as CaCO3 | GN45605 | DA11828-2 | mg/l | 39.5 | 100 | 137 | 97.7 | 80-120% |
| Bromide | GP24222/GN45485 | DA11837-2 | mg/l | 0.0 | 25 | 24.5 | 98.0 | 80-120% |
| Chloride | GP24222/GN45485 | DA11837-2 | mg/l | 74.7 | 250 | 319 | 97.7 | 80-120% |
| Fluoride | GP24222/GN45485 | DA11837-2 | mg/l | 0.0 | 50 | 49.9 | 99.8 | 80-120% |
| Nitrogen, Nitrate | GP24222/GN45485 | DA11837-2 | mg/l | 2.8 | 5 | 7.6 | 96.0 | 80-120% |
| Nitrogen, Nitrite | GP24222/GN45485 | DA11837-2 | mg/l | 1.2 | 2.5 | 3.8 | 104.0 | 80-120% |
| Phosphorus, Total | GP24264/GN45556 | DA11936-1 | mg/l | 0.050 | 0.2 | 0.247 | 98.5 | 90-110% |
| Sulfate | GP24222/GN45485 | DA11837-2 | mg/l | 37.0 | 250 | 275 | 95.2 | 80-120% |

Associated Samples:
Batch GN45605: DA11888-1, DA11888-3, DA11888-5
Batch GP24222: DA11888-1, DA11888-3, DA11888-5
Batch GP24264: DA11888-1, DA11888-3, DA11888-5
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits

MATRIX SPIKE DUPLICATE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: DA11888
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

| Analyte | Batch ID | QC Sample | Units | Original Result | Spike Amount | MSD Result | RPD | QC Limit |
|---|---|---|---|---|---|---|---|---|
| Alkalinity, Total as CaCO3 | GN45605 | DA11828-2 | mg/l | 39.5 | 100 | 134 | 2.2 | 20% |
| Bromide | GP24222/GN45485 | DA11837-2 | mg/l | 0.0 | 25 | 25.9 | 5.6 | 20% |
| Chloride | GP24222/GN45485 | DA11837-2 | mg/l | 74.7 | 250 | 334 | 4.6 | 20% |
| Fluoride | GP24222/GN45485 | DA11837-2 | mg/l | 0.0 | 50 | 53.1 | 6.2 | 20% |
| Nitrogen, Nitrate | GP24222/GN45485 | DA11837-2 | mg/l | 2.8 | 5 | 8.0 | 5.1 | 20% |
| Nitrogen, Nitrite | GP24222/GN45485 | DA11837-2 | mg/l | 1.2 | 2.5 | 3.7 | 2.7 | 20% |
| Sulfate | GP24222/GN45485 | DA11837-2 | mg/l | 37.0 | 250 | 300 | 8.7 | 20% |

Associated Samples:
Batch GN45605: DA11888-1, DA11888-3, DA11888-5
Batch GP24222: DA11888-1, DA11888-3, DA11888-5
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits

SGS
Wheat Ridge, CO

01/02/19

The results set forth herein are provided by SGS North America Inc.

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*Automated Report*

# Technical Report for

## ERM-West, Inc.

Parkdale Quarry GW

0488586

SGS Job Number: DA11888X

Sampling Date: 12/11/18

Report to:

ERM-West, Inc.
555 17th Street Suite #1700
Denver, CO 80111
zack.walker@erm.com; Paul.Mehring@erm.com

ATTN: Zach Walker

Total number of pages in report: **26**

NELAP ACCREDITED TNI LABORATORY

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Scott Heideman
Laboratory Director

Client Service contact: Carissa Cumine 303-425-6021

Certifications: CO (CO00049), ID (CO00049), NE (NE-OS-06-04), ND (R-027), NJ (CO007), OK (D9942)
UT (NELAP CO00049), LA (LA150028), TX (T104704511), WY (8TMS-L)

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# Sample Summary

ERM-West, Inc.

**Job No:** DA11888X

Parkdale Quarry GW
Project No: 0488586

| Sample Number | Collected Date | Time | By | Received | Matrix Code | Type | Client Sample ID |
|---|---|---|---|---|---|---|---|
| DA11888-1X | 12/11/18 | 11:28 PM | | 12/12/18 | AQ | Ground Water | WELL 1:PARKDALE |
| DA11888-3X | 12/11/18 | 15:35 PM | | 12/12/18 | AQ | Ground Water | WELL 3:PARKDALE |
| DA11888-5X | 12/11/18 | 10:52 PM | | 12/12/18 | AQ | Ground Water | WELL 10:PARKDALE |

## Section 2

### Subcontract Lab Data

Report of Analysis

**ACZ Laboratories, Inc.**
*2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493*

# Analytical Report

December 31, 2018

Report to:
Scott Heideman
SGS Accutest
4036 Youngfield Street
Wheat Ridge, CO 80033

Bill to:
Scott Heideman
SGS Accutest
4036 Youngfield Street
Wheat Ridge, CO 80033

cc: Janel Mulholland, Elizabeth Sutcliffe, Elizabeth Bolstad

Project ID:
ACZ Project ID: L48880

Scott Heideman:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on December 14, 2018. This project has been assigned to ACZ's project number, L48880. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L48880. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after January 30, 2019. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

Max Janicek

Max Janicek has reviewed and approved this report.

**ACZ Laboratories, Inc.**
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

## Inorganic Analytical Results

**SGS Accutest**
Project ID:
Sample ID: DA11888X1

ACZ Sample ID: ***L48880-01***
Date Sampled: *12/14/18 11:28*
Date Received: *12/14/18*
Sample Matrix: *Groundwater*

Wet Chemistry

| Parameter | EPA Method | Dilution | Result | Qual | XQ | Units | MDL | PQL | Date | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|
| Residue, Total (TS) @ 105C | SM2540B | 1 | 930 | | | mg/L | 10 | 20 | 12/20/18 15:16 | kja |

**Arizona license number: AZ0102**

# Inorganic Analytical Results

**SGS Accutest**
Project ID:
Sample ID: DA11888X3

ACZ Sample ID: ***L48880-02***
Date Sampled: *12/14/18 15:35*
Date Received: *12/14/18*
Sample Matrix: *Groundwater*

Wet Chemistry

| Parameter | EPA Method | Dilution | Result | Qual | XQ | Units | MDL | PQL | Date | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|
| Residue, Total (TS) @ 105C | SM2540B | 1 | 1410 | | | mg/L | 10 | 20 | 12/20/18 15:17 | kja |

**Arizona license number: AZ0102**

**SGS Accutest**
Project ID:
Sample ID: DA11888X5

ACZ Sample ID: ***L48880-03***
Date Sampled: *12/14/18 10:52*
Date Received: *12/14/18*
Sample Matrix: *Groundwater*

Wet Chemistry

| Parameter | EPA Method | Dilution | Result | Qual | XQ | Units | MDL | PQL | Date | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|
| Residue, Total (TS) @ 105C | SM2540B | 2 | 4320 | | | mg/L | 20 | 40 | 12/20/18 15:17 | kja |

**Arizona license number: AZ0102**

## Report Header Explanations

| | |
|---|---|
| *Batch* | A distinct set of samples analyzed at a specific time |
| *Found* | Value of the QC Type of interest |
| *Limit* | Upper limit for RPD, in %. |
| *Lower* | Lower Recovery Limit, in % (except for LCSS, mg/Kg) |
| *MDL* | Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations. |
| *PCN/SCN* | A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis |
| *PQL* | Practical Quantitation Limit. Synonymous with the EPA term "minimum level". |
| *QC* | True Value of the Control Sample or the amount added to the Spike |
| *Rec* | Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg) |
| *RPD* | Relative Percent Difference, calculation used for Duplicate QC Types |
| *Upper* | Upper Recovery Limit, in % (except for LCSS, mg/Kg) |
| *Sample* | Value of the Sample of interest |

## QC Sample Types

| | | | |
|---|---|---|---|
| *AS* | Analytical Spike (Post Digestion) | *LCSWD* | Laboratory Control Sample - Water Duplicate |
| *ASD* | Analytical Spike (Post Digestion) Duplicate | *LFB* | Laboratory Fortified Blank |
| *CCB* | Continuing Calibration Blank | *LFM* | Laboratory Fortified Matrix |
| *CCV* | Continuing Calibration Verification standard | *LFMD* | Laboratory Fortified Matrix Duplicate |
| *DUP* | Sample Duplicate | *LRB* | Laboratory Reagent Blank |
| *ICB* | Initial Calibration Blank | *MS* | Matrix Spike |
| *ICV* | Initial Calibration Verification standard | *MSD* | Matrix Spike Duplicate |
| *ICSAB* | Inter-element Correction Standard - A plus B solutions | *PBS* | Prep Blank - Soil |
| *LCSS* | Laboratory Control Sample - Soil | *PBW* | Prep Blank - Water |
| *LCSSD* | Laboratory Control Sample - Soil Duplicate | *PQV* | Practical Quantitation Verification standard |
| *LCSW* | Laboratory Control Sample - Water | *SDL* | Serial Dilution |

## QC Sample Type Explanations

| | |
|---|---|
| Blanks | Verifies that there is no or minimal contamination in the prep method or calibration procedure. |
| Control Samples | Verifies the accuracy of the method, including the prep procedure. |
| Duplicates | Verifies the precision of the instrument and/or method. |
| Spikes/Fortified Matrix | Determines sample matrix interferences, if any. |
| Standard | Verifies the validity of the calibration. |

## ACZ Qualifiers (Qual)

| | |
|---|---|
| B | Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity. |
| H | Analysis exceeded method hold time. pH is a field test with an immediate hold time. |
| L | Target analyte response was below the laboratory defined negative threshold. |
| U | The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit. |

## Method References

(1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4) EPA SW-846. Test Methods for Evaluating Solid Waste.
(5) Standard Methods for the Examination of Water and Wastewater.

## Comments

(1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3) Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5) If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

**SGS Accutest**

ACZ Project ID: ***L48880***

*NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.*

**Residue, Total (TS) @ 105C** SM2540B

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Found | Units | Rec% | Lower | Upper | RPD | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG463204** | | | | | | | | | | | | | |
| WG463204PBW | PBW | 12/20/18 15:15 | | | | U | mg/L | | -20 | 20 | | | |
| WG463204LCSW | LCSW | 12/20/18 15:15 | PCN57521 | 420 | | 410 | mg/L | 98 | 80 | 120 | | | |
| L48902-02DUP | DUP | 12/20/18 15:20 | | | 1760 | 1760 | mg/L | | | | 0 | 10 | |

| ACZ ID | WORKNUM | PARAMETER | METHOD | QUAL | DESCRIPTION |
|---|---|---|---|---|---|

No extended qualifiers associated with this analysis

**ACZ Laboratories, Inc.**
*2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493*

## RadioChemistry Analytical Results

**SGS Accutest**
Project ID:
Sample ID: DA11888X1
Locator:

ACZ Sample ID: ***L48880-01***
Date Sampled: *12/14/18 11:28*
Date Received: *12/14/18*
Sample Matrix: *Groundwater*

Gross Alpha & Beta, total
M900.0

Prep Method:

| Parameter | Measure Date | Prep Date | Result | Error(+/-) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Gross Alpha | 12/27/18 0:00 | | 19 | 5.5 | 9.6 | pCi/L | | slm |
| Gross Beta | 12/27/18 0:00 | | 22 | 4.1 | 7.8 | pCi/L | | slm |

Radium 226
M903.1

Prep Method:

| Parameter | Measure Date | Prep Date | Result | Error(+/-) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Radium 226 | 12/27/18 0:05 | | 1 | 0.2 | 0.35 | pCi/L | * | slm |

Radium 228
M904.0

Prep Method:

| Parameter | Measure Date | Prep Date | Result | Error(+/-) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Radium 228 | 12/28/18 12:46 | | 1.5 | 1.3 | 1.3 | pCi/L | | amk |

Uranium, Isotopic
Eichrom ACW03

Prep Method:

| Parameter | Measure Date | Prep Date | Result | Error(+/-) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Uranium 234 | 12/26/18 0:02 | | 16 | 4.6 | 4.7 | pCi/L | * | djc |
| Uranium 235 | 12/26/18 0:02 | | 0.07 | 1.4 | 1.9 | pCi/L | * | djc |
| Uranium 238 | 12/26/18 0:02 | | 9.06 | 3.7 | 3.5 | pCi/L | * | djc |

**Arizona license number: AZ0102**

** Please refer to Qualifier Reports for details.*

**SGS Accutest**
Project ID:
Sample ID: DA11888X3
Locator:

ACZ Sample ID: ***L48880-02***
Date Sampled: *12/14/18 15:35*
Date Received: *12/14/18*
Sample Matrix: *Groundwater*

Gross Alpha & Beta, total
M900.0

Prep Method:

| Parameter | Measure Date | Prep Date | Result | Error(+/-) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Gross Alpha | 12/27/18 0:00 | | 47 | 11 | 15 | pCi/L | | slm |
| Gross Beta | 12/27/18 0:00 | | 71 | 9.3 | 16 | pCi/L | | slm |

Radium 226
M903.1

Prep Method:

| Parameter | Measure Date | Prep Date | Result | Error(+/-) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Radium 226 | 12/27/18 0:07 | | 2.3 | 0.33 | 0.34 | pCi/L | * | slm |

Radium 228
M904.0

Prep Method:

| Parameter | Measure Date | Prep Date | Result | Error(+/-) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Radium 228 | 12/28/18 12:46 | | 2.2 | 1.3 | 1.3 | pCi/L | | amk |

Uranium, Isotopic
Eichrom ACW03

Prep Method:

| Parameter | Measure Date | Prep Date | Result | Error(+/-) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Uranium 234 | 12/26/18 0:04 | | 21 | 5.2 | 3 | pCi/L | * | djc |
| Uranium 235 | 12/26/18 0:04 | | 1.2 | 1.9 | 5.2 | pCi/L | * | djc |
| Uranium 238 | 12/26/18 0:04 | | 9.99 | 3.8 | 2.7 | pCi/L | * | djc |

**Arizona license number: AZ0102**

** Please refer to Qualifier Reports for details.*

**SGS Accutest**
Project ID:
Sample ID: DA11888X5
Locator:

ACZ Sample ID: ***L48880-03***
Date Sampled: *12/14/18 10:52*
Date Received: *12/14/18*
Sample Matrix: *Groundwater*

Gross Alpha & Beta, total
M900.0

Prep Method:

| Parameter | Measure Date | Prep Date | Result | Error(+/-) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Gross Alpha | 12/27/18 0:00 | | 120 | 31 | 58 | pCi/L | | slm |
| Gross Beta | 12/27/18 0:00 | | 200 | 26 | 74 | pCi/L | | slm |

Radium 226
M903.1

Prep Method:

| Parameter | Measure Date | Prep Date | Result | Error(+/-) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Radium 226 | 12/27/18 0:08 | | 4.4 | 0.46 | 0.33 | pCi/L | * | slm |

Radium 228
M904.0

Prep Method:

| Parameter | Measure Date | Prep Date | Result | Error(+/-) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Radium 228 | 12/28/18 12:46 | | 3.1 | 1.4 | 1.3 | pCi/L | | amk |

Uranium, Isotopic
Eichrom ACW03

Prep Method:

| Parameter | Measure Date | Prep Date | Result | Error(+/-) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Uranium 234 | 12/26/18 0:05 | | 25 | 5 | 1.9 | pCi/L | * | djc |
| Uranium 235 | 12/26/18 0:05 | | 0.96 | 1.3 | 2.3 | pCi/L | * | djc |
| Uranium 238 | 12/26/18 0:05 | | 17.2 | 4.1 | 2.8 | pCi/L | * | djc |

**Arizona license number: AZ0102**

# Radiochemistry Reference

## Report Header Explanations

| | |
|---|---|
| *Batch* | A distinct set of samples analyzed at a specific time |
| *Error(+/-)* | Calculated sample specific uncertainty |
| *Found* | Value of the QC Type of interest |
| *Limit* | Upper limit for RPD, in %. |
| *LCL* | Lower Control Limit, in % (except for LCSS, mg/Kg) |
| *LLD* | Calculated sample specific Lower Limit of Detection |
| *PCN/SCN* | A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis |
| *PQL* | Practical Quantitation Limit |
| *QC* | True Value of the Control Sample or the amount added to the Spike |
| *Rec* | Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg) |
| *RER* | Relative Error Ratio, calculation used for Dup. QC taking into account the error factor. |
| *RPD* | Relative Percent Difference, calculation used for Duplicate QC Types |
| *UCL* | Upper Control Limit, in % (except for LCSS, mg/Kg) |
| *Sample* | Value of the Sample of interest |

## QC Sample Types

| | | | |
|---|---|---|---|
| *DUP* | Sample Duplicate | *MS/MSD* | Matrix Spike/Matrix Spike Duplicate |
| *LCSS* | Laboratory Control Sample - Soil | *PBS* | Prep Blank - Soil |
| *LCSW* | Laboratory Control Sample - Water | *PBW* | Prep Blank - Water |

## QC Sample Type Explanations

| | |
|---|---|
| Blanks | Verifies that there is no or minimal contamination in the prep method procedure. |
| Control Samples | Verifies the accuracy of the method, including the prep procedure. |
| Duplicates | Verifies the precision of the instrument and/or method. |
| Matrix Spikes | Determines sample matrix interferences, if any. |

## ACZ Qualifiers (Qual)

| | |
|---|---|
| H | Analysis exceeded method hold time. |

## Method Prefix Reference

| | |
|---|---|
| M | EPA methodology, including those under SDWA, CWA, and RCRA |
| SM | Standard Methods for the Examination of Water and Wastewater. |
| D | ASTM |
| RP | DOE |
| ESM | DOE/ESM |

## Comments

(1) Solid matrices are reported on a dry weight basis.

(2) Preparation method: "Method" indicates preparation defined in analytical method.

(3) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.

(4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.

For a complete list of ACZ's Extended Qualifiers, please click: http://www.acz.com/public/extquallist.pdf

## Radiochemistry QC Summary

**SGS Accutest**

ACZ Project ID: ***L48880***

*NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.*

### Alpha

M900.0

**Units:** pCi/L

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Error | LLD | Found | Error | LLD | Rec% | Lower | Upper | RPD/RER | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG463585** | | | | | | | | | | | | | | | | |
| L48894-02DUP | DUP-RER | 12/27/18 | | | 1.3 | 2.2 | 9 | 3.2 | 2.8 | 9 | | | | 0.53 | 2 | |
| L48894-03MS | MS | 12/27/18 | PCN57385 | 100 | 0.83 | 1.1 | 4 | 110 | 8.9 | 4 | 109 | 67 | 144 | | | |
| WG463100LCSWA | LCSW | 12/27/18 | PCN57385 | 66.67 | | | | 77 | 5.9 | 0.83 | 116 | 67 | 144 | | | |
| WG463100PBW | PBW | 12/27/18 | | | | | | -.2 | 0.45 | 0.81 | | | 1.62 | | | |
| L48864-01DUP | DUP-RER | 12/27/18 | | | 3.6 | 2.1 | 1.7 | 7 | 2.8 | 1.8 | | | | 0.97 | 2 | |

### Beta

M900.0

**Units:** pCi/L

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Error | LLD | Found | Error | LLD | Rec% | Lower | Upper | RPD/RER | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG463585** | | | | | | | | | | | | | | | | |
| WG463100LCSWB | LCSW | 12/27/18 | PCN56196 | 66.67 | | | | 68 | 4.3 | 1.9 | 102 | 82 | 122 | | | |
| WG463100PBW | PBW | 12/27/18 | | | | | | -1.9 | 1.4 | 1.7 | | | 3.4 | | | |
| L48894-05MS | MS | 12/27/18 | PCN56196 | 100 | 6.9 | 3 | 6.9 | 100 | 6.8 | 12 | 93 | 82 | 122 | | | |
| L48894-02DUP | DUP-RER | 12/27/18 | | | 2.8 | 2.8 | 7.1 | 5.3 | 3 | 7.1 | | | | 0.61 | 2 | |
| L48864-01DUP | DUP-RER | 12/27/18 | | | 4 | 2 | 1.9 | 3.3 | 2 | 1.9 | | | | 0.25 | 2 | |

### Radium 226

M903.1

**Units:** pCi/L

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Error | LLD | Found | Error | LLD | Rec% | Lower | Upper | RPD/RER | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG463571** | | | | | | | | | | | | | | | | |
| WG463076PBW | PBW | 12/27/18 | | | | | | .09 | 0.09 | 0.28 | | | 0.56 | | | |
| WG463076LCSW | LCSW | 12/27/18 | PCN57865 | 20 | | | | 19 | 0.55 | 0.16 | 95 | 43 | 148 | | | |
| L48885-01DUP | DUP-RER | 12/27/18 | | | 0.18 | 0.06 | 0.09 | .09 | 0.09 | 0.06 | | | | 0.83 | 2 | |
| L48894-04DUP | DUP-RER | 12/27/18 | | | 0.04 | 0.09 | 0.09 | .16 | 0.07 | 0.1 | | | | 1.05 | 2 | |
| L48885-02MS | MS | 12/27/18 | PCN57865 | 20 | 0.15 | 0.09 | 0.11 | 20 | 0.55 | 0.17 | 99 | 43 | 148 | | | |

**SGS Accutest**

ACZ Project ID: ***L48880***

*NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.*

**Radium 228** M904.0 **Units:** pCi/L

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Error | LLD | Found | Error | LLD | Rec% | Lower | Upper | RPD/RER | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG463689** | | | | | | | | | | | | | | | | |
| WG462911LCSW | LCSW | 12/28/18 | PCN57186 | 9.58 | | | | 8.7 | 1 | 0.71 | 91 | 47 | 123 | | | |
| WG462911PBW | PBW | 12/28/18 | | | | | | 1.1 | 0.65 | 0.62 | | | 1.24 | | | |
| L48868-01DUP | DUP-RER | 12/28/18 | | | 0.75 | 0.65 | 0.65 | .42 | 1.6 | 1.7 | | | | 0.19 | 2 | |
| L48894-07DUP | DUP-RER | 12/28/18 | | | 0.6 | 0.69 | 0.7 | .2 | 0.7 | 0.72 | | | | 0.41 | 2 | |
| L48868-01MS | MS | 12/28/18 | PCN57186 | 9.58 | 0.75 | 0.65 | 0.65 | 8.7 | 1.1 | 0.81 | 83 | 47 | 123 | | | |

**Uranium 234** Eichrom ACW03 **Units:** pCi/L

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Error | LLD | Found | Error | LLD | Rec% | Lower | Upper | RPD/RER | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG463498** | | | | | | | | | | | | | | | | |
| WG463263PBW | PBW | 12/26/18 | | | | | | .03 | 0.47 | 0.84 | | | 1.68 | | | |
| WG463263LCSW | LCSW | 12/26/18 | RC180718-10 | 98 | | | | 98 | 7.9 | 1 | 100 | 77 | 122 | | | |
| L48885-01DUP | DUP-RER | 12/26/18 | | | 4.4 | 1.4 | 1.1 | 6 | 1.7 | 0.8 | | | | 0.73 | 2 | |
| L48894-05DUP | DUP-RER | 12/26/18 | | | 2.4 | 1.1 | 0.78 | 3 | 1.4 | 2.4 | | | | 0.34 | 2 | |
| L48886-01MS | MS | 12/26/18 | RC180718-10 | 98 | 1 | 0.88 | 0.79 | 96 | 8 | 5.3 | 97 | 77 | 122 | | | |

**Uranium 235** Eichrom ACW03 **Units:** pCi/L

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Error | LLD | Found | Error | LLD | Rec% | Lower | Upper | RPD/RER | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG463498** | | | | | | | | | | | | | | | | |
| WG463263PBW | PBW | 12/26/18 | | | | | | -.1 | 0.34 | 0.56 | | | 1.12 | | | |
| WG463263LCSW | LCSW | 12/26/18 | RC180718-10 | 4.48 | | | | 3.4 | 1.5 | 0.42 | 76 | 42 | 136 | | | |
| L48885-01DUP | DUP-RER | 12/26/18 | | | -0.22 | 0.53 | 0.77 | .77 | 0.57 | 1.3 | | | | 1.27 | 2 | |
| L48894-05DUP | DUP-RER | 12/26/18 | | | 0.11 | 0.23 | 0.31 | -.18 | 0.37 | 0.74 | | | | 0.67 | 2 | |
| L48886-01MS | MS | 12/26/18 | RC180718-10 | 4.48 | 0.33 | 0.37 | 1.2 | 3.2 | 1.7 | 2.7 | 64 | 42 | 136 | | | |

**SGS Accutest**

ACZ Project ID: ***L48880***

*NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.*

**Uranium 238** Eichrom ACW03 **Units:** pCi/L

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Error | LLD | Found | Error | LLD | Rec% | Lower | Upper | RPD/RER | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG463498** | | | | | | | | | | | | | | | | |
| WG463263PBW | PBW | 12/26/18 | | | | | | .1 | 0.34 | 0.63 | | | 1.26 | | | |
| WG463263LCSW | LCSW | 12/26/18 | RC180718-10 | 97.5 | | | | 102 | 8 | 0.42 | 105 | 87 | 124 | | | |
| L48885-01DUP | DUP-RER | 12/26/18 | | | 3.22 | 1.3 | 0.76 | 5.01 | 1.5 | 1.3 | | | | 0.9 | 2 | |
| L48894-05DUP | DUP-RER | 12/26/18 | | | 3.17 | 1.3 | 0.31 | 2.81 | 1.3 | 1.4 | | | | 0.2 | 2 | |
| L48886-01MS | MS | 12/26/18 | RC180718-10 | 97.5 | 0.87 | 0.67 | 1.3 | 107 | 8.5 | 5.8 | 109 | 87 | 124 | | | |

## RadChem Extended Qualifier Report

**SGS Accutest**

ACZ Project ID: ***L48880***

| ACZ ID | WORKNUM | PARAMETER | METHOD | QUAL | DESCRIPTION |
|---|---|---|---|---|---|
| **L48880-01** | WG463571 | Radium 226 | M903.1 | DD | Sample required dilution due to matrix color or odor. |
| | WG463498 | Uranium 234 | Eichrom ACW03 | D1 | Sample required dilution due to matrix. |
| | | Uranium 235 | Eichrom ACW03 | D1 | Sample required dilution due to matrix. |
| | | Uranium 238 | Eichrom ACW03 | D1 | Sample required dilution due to matrix. |
| **L48880-02** | WG463571 | Radium 226 | M903.1 | DD | Sample required dilution due to matrix color or odor. |
| | WG463498 | Uranium 234 | Eichrom ACW03 | D1 | Sample required dilution due to matrix. |
| | | Uranium 235 | Eichrom ACW03 | D1 | Sample required dilution due to matrix. |
| | | Uranium 238 | Eichrom ACW03 | D1 | Sample required dilution due to matrix. |
| **L48880-03** | WG463571 | Radium 226 | M903.1 | DD | Sample required dilution due to matrix color or odor. |
| | WG463498 | Uranium 234 | Eichrom ACW03 | D1 | Sample required dilution due to matrix. |
| | | Uranium 235 | Eichrom ACW03 | D1 | Sample required dilution due to matrix. |
| | | Uranium 238 | Eichrom ACW03 | D1 | Sample required dilution due to matrix. |

Radiochemistry

| **The following parameters are not offered for certification or are not covered by AZ certificate #AZ0102.** | |
|---|---|
| Uranium 234 | Eichrom ACW03 |
| Uranium 235 | Eichrom ACW03 |
| Uranium 238 | Eichrom ACW03 |

| **The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.** | |
|---|---|
| Uranium 234 | Eichrom ACW03 |
| Uranium 235 | Eichrom ACW03 |
| Uranium 238 | Eichrom ACW03 |

**ACZ Laboratories, Inc.**
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

# Sample Receipt

SGS Accutest

ACZ Project ID: L48880
Date Received: 12/14/2018 13:57
Received By:
Date Printed: 12/17/2018

## Receipt Verification

| | YES | NO | NA |
|---|---|---|---|
| 1) Is a foreign soil permit included for applicable samples? | | | X |
| 2) Is the Chain of Custody form or other directive shipping papers present? | X | | ▨ |
| 3) Does this project require special handling procedures such as CLP protocol? | | X | ▨ |
| 4) Are any samples NRC licensable material? | | | X |
| 5) If samples are received past hold time, proceed with requested short hold time analyses? | X | | ▨ |
| 6) Is the Chain of Custody form complete and accurate? | X | | ▨ |
| 7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples? | | X | ▨ |

## Samples/Containers

| | YES | NO | NA |
|---|---|---|---|
| 8) Are all containers intact and with no leaks? | X | | ▨ |
| 9) Are all labels on containers and are they intact and legible? | X | | ▨ |
| 10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time? | X | | ▨ |
| 11) For preserved bottle types, was the pH checked and within limits? [1] | X | | |
| 12) Is there sufficient sample volume to perform all requested work? | X | | ▨ |
| 13) Is the custody seal intact on all containers? | | | X |
| 14) Are samples that require zero headspace acceptable? | | | X |
| 15) Are all sample containers appropriate for analytical requirements? | X | | ▨ |
| 16) Is there an Hg-1631 trip blank present? | | | X |
| 17) Is there a VOA trip blank present? | | | X |
| 18) Were all samples received within hold time? | X | | ▨ |

NA indicates Not Applicable

## Chain of Custody Related Remarks

## Client Contact Remarks

## Shipping Containers

```
Cooler Id  Temp(°C)    Temp       Rad(µR/Hr)  Custody Seal
                   Criteria(°C)                 Intact?
---------  --------  ------------  ----------  ------------
NA29696    2.4       <=6.0         15          Yes
```

Was ice present in the shipment container(s)?

`Yes - Wet ice was present in the shipment container(s).`

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

SGS Accutest

ACZ Project ID: L48880
Date Received: 12/14/2018 13:57
Received By:
Date Printed: 12/17/2018

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

L48880 Chain of Custod

LL18880

# CHAIN OF CUSTODY

SGS North America Inc. - Wheat Ridge
4036 Youngfield Street, Wheat Ridge, CO 80033
TEL: 303-425-6021 FAX: 303-425-6854
www.sgs.com/ehsusa

Page 1 of 1

FED-EX Tracking #:
Bottle Order Control #:
SGS Quote #:
SGS Job #: DA11888X

## Client / Reporting Information

Company Name: SGS North America Inc.
Street Address: 4036 Youngfield Street
City: Wheat Ridge, State: CO, Zip: 8003:
Project Contact: E-mail: jeremy.dechant@sgs.com
Phone #: 303-425-6021 Fax #:
Sampler(s) Name(s): PM Phone:

## Project Information

Project Name: DA11888X
Street:
City: State:
Project #:
Client Purchase Order #:
Project Manager:

Billing Information ( if different from Report to)
Company Name:
Street Address:
City: State: Zip:
Attention:

## Requested Analysis ( see TEST CODE sheet)

| SGS Sample # | Field ID / Point of Collection | MEOH/DI Vial # | Collection Date | Collection Time | Sampled by | Matrix | # of bottles | HCl | NaOH | HNO3 | H2SO4 | NONE | DI Water | MEOH | ENCORE | Gross Alpha + Beta + total solids<br>900 (ww) | Radium 226/228<br>903.1 | Isotopic Uranium<br>ACW03 | LAB USE ONLY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1X | DA11888X | | 12/11/18 | 11:28:00 AM | PM | AQ | | | | | | | | | | X | X | X | |
| 3X | DA11888X | | 12/11/18 | 3:35:00 PM | PM | AQ | | | | | | | | | | X | X | X | |
| 5X | DA11888X | | 12/11/18 | 10:52:00 AM | PM | AQ | | | | | | | | | | X | X | X | |

Number of preserved Bottles

### Matrix Codes

DW - Drinking Water
GW - Ground Water
WW - Water
SW - Surface Water
SO - Soil
SL- Sludge
SED-Sediment
OI - Oil
LIQ - Other Liquid
AIR - Air
SOL - Other Solid
WP - Wipe
FB-Field Blank
EB-Equipment Blank
RB- Rinse Blank
TB-Trip Blank

### Turnaround Time ( Business days)

Approved By (SGS PM): / Date:

☐ Standard 10 Day (business)
☐ 5 Business Days RUSH
☐ 3 Business Days RUSH
☐ 2 Business Days RUSH
☐ 1 Business Day EMERGENCY
☒ other 42

Emergency & Rush T/A data available via Lablink Approval needed for RUSH/Emergency TAT

### Data Deliverable Information

☐ Commercial "A" (Level 1)
☐ Commercial "B" ( Level 2)
☐ REDT1 ( Level 3)
☐ FULT1 ( Level 4)
☐ Commercial "C"
☐ State Forms
☐ EDD Format
☐ Other
☐
☒ CC

Commercial "A" = Results Only
Commercial "B" = Results + QC Summary
Commercial "C" = Results + QC Summary + Partial Raw data

### Comments / Special Instructions

http://www.sgs.com/en/terms-and-conditions

**Sample Custody must be documented below each time samples change possession, including courier delivery.**

| | | | | | |
|---|---|---|---|---|---|
| Relinquished by Sampler: 1 | Date Time: 12/13/18 | Received By: 1 | Relinquished By: 2 | Date Time: | Received By: 2 |
| Relinquished by Sampler: 3 | Date Time: | Received By: 3 12/14/18 13:57 | Relinquished By: 4 | Date Time: | Received By: 4 |
| Relinquished by: 5 | Date Time: | Received By: 5 | Custody Seal # | ☐ Intact<br>☐ Not intact | Preserved where applicable ☐ Therm. ID: On Ice ☐ Cooler Temp. |

# Misc. Forms

## Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

# CHAIN OF ~~CUSTODY~~

4036 Youngfield Street, Wheat Ridge, CO 80033
TEL: 303-425-6021 FAX: 303-425-6854
www.accutest.com

Page ___ of ___

| | |
|---|---|
| Bottle Order Control # | FED-EX Tracking # |
| SGS Quote # | SGS Job # DA11888 |

| Client / Reporting Information | Project Information | |
|---|---|---|
| Company: ERM-West, Inc. | Project Name: Parkdale Quarry GW | |
| Street: 555 17th ST, #1700 | Street: | Billing Information (if different from Report to) |
| City, State: Denver, CO | City, State: | Company: ermwest accountsreceivable |
| Project Contact: Zach Walker | Project #: 0488586 | Street Address: @erm.com |
| Phone: 303-741-5050<br>Email: zack.walker@erm.com | Client Purchase Order #: | City, State ZIP: |
| Sampler(s) Name(s): Z.Walker, P.Mehring | Project Manager: Becky Moore | Attention: |

| Field ID / Point of Collection | Collection Date | Collection Time | Sampled by | Matrix | # of bottles | NONE | HCl | NaOH | HNO3 | H2SO4 | DI Water | MEOH | ENCORE | Na2S2O3 | Na2SO3 | Alkalinity (sm 2320B-2011) | Dissolved Metals LF (EPA 200.8) | $SO_4$, $NO_3$O, CHL (EPA 300.0) | TDS (sm 4500-PE-2011) | Total $PO_4$ (sm 4500-P E-2011) | Isotopic Uranium | Gross Alpha/Beta + total | Radium 226 | Radium 228 | | | LAB USE ONLY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Well 1: Parkdale | 12/11/18 | 11:28 | PM | GW | 12 | 5 | | | 6 | 1 | | | | | | X | X | X | X | X | X | X | X | X | | | 01 |
| Well 1: Parkdale Dup | 12/11/18 | 11:28 | ↓ | ↓ | 12 | 5 | | | 6 | 1 | | | | | | HOLD | | | PENDING | | | | ANALSIS | | | | 02 |
| Well 3 Parkdale | 12/11/18 | 15:35 | ↓ | ↓ | 12 | 5 | | | 6 | 1 | | | | | | X | X | X | X | X | X | X | X | X | | | 03 |
| Well 3 Parkdale Dup | 12/11/18 | 15:35 | ↓ | ↓ | 12 | 5 | | | 6 | 1 | | | | | | HOLD | | | | | | | | | | | 04 |
| Well 10 Parkdale | 12/12/18 | 10:52 | ↓ | ↓ | 12 | 5 | | | 6 | 1 | | | | | | X | X | X | X | X | X | X | X | X | | | 05 |
| Well 10 Parkdale Dup | 12/12/18 | 10:52 | ↓ | ↓ | 12 | 5 | | | 6 | 1 | | | | | | HOLD | | | | | | | | | | | 06 |

**Matrix Codes**

DW - Drinking Water
GW - Ground Water
WW - Water
SW - Surface Water
SO - Soil
SL- Sludge
SED-Sediment
OI - Oil
LIQ - Other Liquid
AIR - Air
SOL - Other Solid
WP - Wipe
FB-Field Blank
EB-Equipment Blank
RB- Rinse Blank
TB-Trip Blank

**Turnaround Time (Business days)**

☒ Std. 10 Business Days
☐ 5 Day RUSH
☐ 3 Day Emergency
☐ 2 Day Emergency
☐ 1 Day Emergency

Emergency & Rush T/A data available VIA LabLink. RUSH TAT approval needed.

**Special Reporting Instructions**

☐ Report in PPB
☐ Report in PPM
☐ Report MDLs

**Data Deliverable Information**

☐ Commercial "A" (Level 1, Results Only)
☒ Commercial "B" (Level 2, Results + QC Summary)
☐ COMMBN (Results/QC/Narrative)
☐ COMMBN+ [Results/QC/Narrative (+ chromatograms)]
☐ REDT2
☐ FULT1
☐ EDD Format ___________

**Comments / Special Instructions**

**Sample Custody must be documented below each time samples change possession, including courier delivery.**

| | | | | | |
|---|---|---|---|---|---|
| Relinquished by Sampler: 1 | Date/Time: 12/12/18 1705 | Received By: 1 | Relinquished By: 2 | Date/Time: | Received By: 2 |
| Relinquished by Sampler: 3 | Date/Time: | Received By: 3 | Relinquished By: 4 | Date/Time: | Received By: 4 |
| Custody Seal # Intact ☒ Not intact ☐ Absent ☐ | | Preserved where applicable ☒ HIO | Cooler Temp. °C: 1.1 Therm. ID: T18C | On Ice ☒ | Form MSQA 064-01, RV 6/19/17<br>http://www.sgs.com/terms-and-conditions |

# SGS Accutest Sample Receipt Summary

**Job Number:** DA11888 **Client:** ERM **Project:** PARKDALE

**Date / Time Received:** 12/12/2018 5:05:00 PM **Delivery Method:** **Airbill #'s:** HD

**Cooler Temps (Initial/Adjusted):** #1: (1.1/1.1);

| **Cooler Security** | Y | N | | Y | N |
|---|---|---|---|---|---|
| 1. Custody Seals Present: | ☑ | ☐ | 3. COC Present: | ☑ | ☐ |
| 2. Custody Seals Intact: | ☑ | ☐ | 4. Smpl Dates/Time OK | ☑ | ☐ |

| **Cooler Temperature** | Y | N |
|---|---|---|
| 1. Temp criteria achieved: | ☑ | ☐ |
| 2. Cooler temp verification: | Bar Therm; | |
| 3. Cooler media: | Ice (Bag) | |
| 4. No. Coolers: | 1 | |

| **Quality Control Preservation** | Y | N | N/A |
|---|---|---|---|
| 1. Trip Blank present / cooler: | ☐ | ☐ | ☑ |
| 2. Trip Blank listed on COC: | ☐ | ☐ | ☑ |
| 3. Samples preserved properly: | ☑ | ☐ | |
| 4. VOCs headspace free: | ☐ | ☐ | ☑ |

| **Sample Integrity - Documentation** | Y | N |
|---|---|---|
| 1. Sample labels present on bottles: | ☑ | ☐ |
| 2. Container labeling complete: | ☑ | ☐ |
| 3. Sample container label / COC agree: | ☑ | ☐ |

| **Sample Integrity - Condition** | Y | N |
|---|---|---|
| 1. Sample recvd within HT: | ☑ | ☐ |
| 2. All containers accounted for: | ☑ | ☐ |
| 3. Condition of sample: | Intact | |

| **Sample Integrity - Instructions** | Y | N | N/A |
|---|---|---|---|
| 1. Analysis requested is clear: | ☑ | ☐ | |
| 2. Bottles received for unspecified tests | ☐ | ☑ | |
| 3. Sufficient volume recvd for analysis: | ☑ | ☐ | |
| 4. Compositing instructions clear: | ☐ | ☐ | ☑ |
| 5. Filtering instructions clear: | ☐ | ☐ | ☑ |

Comments

SGS

Wheat Ridge, CO

06/03/19

The results set forth herein are provided by SGS North America Inc.

*e-Hardcopy 2.0*
*Automated Report*

# Technical Report for

ERM-West, Inc.

Parkdale Quarry GW

Proj# 0488586

SGS Job Number: DA15855

Sampling Dates: 05/13/19 - 05/14/19

Report to:

ERM-West, Inc.
555 17th Street Suite #1700
Denver, CO 80111
zack.walter@erm.com

ATTN: Zack Walter

Total number of pages in report: **35**

NELAP ACCREDITED TNI LABORATORY

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.

Scott Heideman
Laboratory Director

Client Service contact: Carissa Cumine 303-425-6021

Certifications: CO (CO00049), ID (CO00049), NE (NE-OS-06-04), ND (R-027), NJ (CO007), OK (D9942) UT (NELAP CO00049), LA (LA150028), TX (T104704511), WY (8TMS-L)

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how we can serve you better at:
EHS.US.CustomerCare@sgs.com

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# Sample Summary

ERM-West, Inc.

**Job No:** DA15855

Parkdale Quarry GW
Project No: Proj# 0488586

| Sample | Collected | | | | Matrix | | Client |
|---|---|---|---|---|---|---|---|
| **Number** | **Date** | **Time** | **By** | **Received** | **Code** | **Type** | **Sample ID** |
| DA15855-1 | 05/14/19 | 13:00 | ZW | 05/15/19 | AQ | Ground Water | WELL 1 |
| DA15855-1F | 05/14/19 | 13:00 | ZW | 05/15/19 | AQ | Groundwater Filtered | WELL 1 |
| DA15855-3 | 05/13/19 | 13:20 | ZW | 05/15/19 | AQ | Ground Water | WELL 3 PARKDALE |
| DA15855-3F | 05/13/19 | 13:20 | ZW | 05/15/19 | AQ | Groundwater Filtered | WELL 3 PARKDALE |
| DA15855-5 | 05/13/19 | 16:30 | ZW | 05/15/19 | AQ | Ground Water | WELL 10 |
| DA15855-5F | 05/13/19 | 16:30 | ZW | 05/15/19 | AQ | Groundwater Filtered | WELL 10 |

# CASE NARRATIVE / CONFORMANCE SUMMARY

| | | | |
|---|---|---|---|
| **Client:** | ERM-West, Inc. | **Job No** | DA15855 |
| **Site:** | Parkdale Quarry GW | **Report Date** | 6/3/2019 5:54:09 PM |

On 05/15/2019, 3 sample(s), 0 Trip Blank(s), and 0 Field Blank(s) were received at SGS North America Inc. (SGS) at a temperature of 2.2 °C. The samples were intact and properly preserved, unless noted below. An SGS Job Number of DA15855 was assigned to the project. The lab sample ID, client sample ID, and date of sample collection are detailed in the report's Results Summary.

Specified quality control criteria were achieved for this job except as noted below. For more information, please refer to the analytical results and QC summary pages.

## Metals Analysis By Method EPA 200.7

**Matrix:** AQ **Batch ID:** MP28042

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA15903-1FMS, DA15903-1FMSD were used as the QC samples for the metals analysis.
- MP28042-MB1 for Silicon: All sample results >10x method blank concentration.

## Metals Analysis By Method EPA 200.8

**Matrix:** AQ **Batch ID:** MP28044

- All samples were digested and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA15925-1AMS, DA15925-1AMSD were used as the QC samples for the metals analysis.
- The matrix spike (MS) recovery(s) of Sodium are outside control limits. Spike amount low relative to the sample amount. Refer to lab control or spike blank for recovery information.
- DA15855-1F and -5F for Cobalt: Elevated detection limit due to dilution required for possible matrix interference.
- MP28044-MB1 for Iron: All sample results < RL or > 10x MB concentration.

## General Chemistry By Method EPA 365.1

**Matrix:** AQ **Batch ID:** GP25206

- All samples were prepared and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA16059-1MS, DA15986-1DUP were used as the QC samples for the Phosphorus, Total analysis.
- The duplicate RPD(s) for Phosphorus, Total are outside control limits for sample GP25206-D1. RPD acceptable due to low duplicate and sample concentrations.

## General Chemistry By Method EPA300.0/SW846 9056A

**Matrix:** AQ **Batch ID:** GP25118

- All samples were prepared and analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA15856-3MS, DA15856-3MSD were used as the QC samples for the Chloride, Nitrogen, Nitrate, Sulfate, Chloride analysis.

## General Chemistry By Method SM 2320B-2011

**Matrix:** AQ **Batch ID:** GN47063

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA15692-4MS, DA15692-4MSD, DA16000-1DUP were used as the QC samples for the Alkalinity, Total as CaCO3 analysis.

## General Chemistry By Method SM 2540C-2011

**Matrix:** AQ **Batch ID:** GN46967

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) DA15829-1DUP were used as the QC samples for the Solids, Total Dissolved analysis.

SGS certifies that data reported for samples received, listed on the associated custody chain or analytical task order, were produced to specifications meeting SGS's Quality System precision, accuracy and completeness objectives except as noted.

Estimated non-standard method measurement uncertainty data is available on request, based on quality control bias and implicit for standard methods. Acceptable uncertainty requires tested parameter quality control data to meet method criteria.

SGS is not responsible for data quality assumptions if partial reports are used and recommends that this report be used in its entirety. This report is authorized by SGS indicated via signature on the report cover.

# Summary of Hits

**Job Number:** DA15855
**Account:** ERM-West, Inc.
**Project:** Parkdale Quarry GW
**Collected:** 05/13/19 thru 05/14/19

| Lab Sample ID<br>Analyte | Client Sample ID | Result/<br>Qual | RL | MDL | Units | Method |
|---|---|---|---|---|---|---|
| **DA15855-1** | **WELL 1** | | | | | |
| Alkalinity, Total as CaCO3 | | 188 | 5.0 | | mg/l | SM 2320B-2011 |
| Chloride | | 7.5 | 5.0 | | mg/l | EPA300.0/SW846 9056A |
| Nitrogen, Nitrate | | 6.5 | 0.25 | | mg/l | EPA300.0/SW846 9056A |
| Phosphorus, Total | | 0.31 | 0.010 | | mg/l | EPA 365.1 |
| Solids, Total Dissolved | | 417 | 10 | | mg/l | SM 2540C-2011 |
| Sulfate | | 95.8 | 5.0 | | mg/l | EPA300.0/SW846 9056A |
| **DA15855-1F** | **WELL 1** | | | | | |
| Arsenic | | 0.40 | 0.40 | | ug/l | EPA 200.8 |
| Barium | | 20.7 | 4.0 | | ug/l | EPA 200.8 |
| Calcium | | 75800 | 800 | | ug/l | EPA 200.8 |
| Iron | | 122 | 20 | | ug/l | EPA 200.8 |
| Magnesium | | 15100 | 200 | | ug/l | EPA 200.8 |
| Manganese | | 2.9 | 2.0 | | ug/l | EPA 200.8 |
| Molybdenum | | 18.8 | 2.0 | | ug/l | EPA 200.8 |
| Potassium | | 3030 | 400 | | ug/l | EPA 200.8 |
| Selenium | | 3.8 | 0.80 | | ug/l | EPA 200.8 |
| Silicon | | 7640 | 50 | | ug/l | EPA 200.7 |
| Sodium | | 23100 | 1000 | | ug/l | EPA 200.8 |
| Uranium | | 13.7 | 0.40 | | ug/l | EPA 200.8 |
| **DA15855-3** | **WELL 3 PARKDALE** | | | | | |
| Alkalinity, Total as CaCO3 | | 168 | 5.0 | | mg/l | SM 2320B-2011 |
| Chloride | | 9.9 | 2.5 | | mg/l | EPA300.0/SW846 9056A |
| Nitrogen, Nitrate | | 2.6 | 0.25 | | mg/l | EPA300.0/SW846 9056A |
| Phosphorus, Total | | 0.41 | 0.010 | | mg/l | EPA 365.1 |
| Solids, Total Dissolved | | 318 | 10 | | mg/l | SM 2540C-2011 |
| Sulfate | | 55.7 | 2.5 | | mg/l | EPA300.0/SW846 9056A |
| **DA15855-3F** | **WELL 3 PARKDALE** | | | | | |
| Arsenic | | 0.43 | 0.40 | | ug/l | EPA 200.8 |
| Barium | | 18.9 | 4.0 | | ug/l | EPA 200.8 |
| Calcium | | 48100 | 800 | | ug/l | EPA 200.8 |
| Iron | | 82.2 | 20 | | ug/l | EPA 200.8 |
| Magnesium | | 10600 | 200 | | ug/l | EPA 200.8 |
| Manganese | | 12.8 | 2.0 | | ug/l | EPA 200.8 |
| Molybdenum | | 155 | 2.0 | | ug/l | EPA 200.8 |
| Nickel | | 11.2 | 4.0 | | ug/l | EPA 200.8 |
| Potassium | | 2130 | 400 | | ug/l | EPA 200.8 |
| Selenium | | 2.2 | 0.80 | | ug/l | EPA 200.8 |

# Summary of Hits

**Job Number:** DA15855
**Account:** ERM-West, Inc.
**Project:** Parkdale Quarry GW
**Collected:** 05/13/19 thru 05/14/19

| Lab Sample ID<br>Analyte | Client Sample ID | Result/<br>Qual | RL | MDL | Units | Method |
|---|---|---|---|---|---|---|
| Silicon | | 10700 | 50 | | ug/l | EPA 200.7 |
| Sodium | | 28200 | 1000 | | ug/l | EPA 200.8 |
| Uranium | | 19.7 | 0.40 | | ug/l | EPA 200.8 |
| **DA15855-5** | **WELL 10** | | | | | |
| Alkalinity, Total as CaCO3 | | 228 | 5.0 | | mg/l | SM 2320B-2011 |
| Chloride | | 7.5 | 2.5 | | mg/l | EPA300.0/SW846 9056A |
| Nitrogen, Nitrate | | 0.087 | 0.050 | | mg/l | EPA300.0/SW846 9056A |
| Phosphorus, Total | | 0.81 | 0.010 | | mg/l | EPA 365.1 |
| Solids, Total Dissolved | | 420 | 10 | | mg/l | SM 2540C-2011 |
| Sulfate | | 85.9 | 2.5 | | mg/l | EPA300.0/SW846 9056A |
| **DA15855-5F** | **WELL 10** | | | | | |
| Arsenic | | 0.40 | 0.40 | | ug/l | EPA 200.8 |
| Barium | | 34.0 | 4.0 | | ug/l | EPA 200.8 |
| Calcium | | 76400 | 800 | | ug/l | EPA 200.8 |
| Copper | | 5.2 | 4.0 | | ug/l | EPA 200.8 |
| Iron | | 140 | 20 | | ug/l | EPA 200.8 |
| Magnesium | | 14800 | 200 | | ug/l | EPA 200.8 |
| Manganese | | 5.0 | 2.0 | | ug/l | EPA 200.8 |
| Molybdenum | | 7.3 | 2.0 | | ug/l | EPA 200.8 |
| Potassium | | 1640 | 400 | | ug/l | EPA 200.8 |
| Selenium | | 1.2 | 0.80 | | ug/l | EPA 200.8 |
| Silicon | | 13200 | 50 | | ug/l | EPA 200.7 |
| Sodium | | 20000 | 1000 | | ug/l | EPA 200.8 |
| Uranium | | 16.7 | 0.40 | | ug/l | EPA 200.8 |

## Sample Results

Report of Analysis

# Report of Analysis

| | | | |
|---|---|---|---|
| **Client Sample ID:** | WELL 1 | | |
| **Lab Sample ID:** | DA15855-1 | **Date Sampled:** | 05/14/19 |
| **Matrix:** | AQ - Ground Water | **Date Received:** | 05/15/19 |
| | | **Percent Solids:** | n/a |
| **Project:** | Parkdale Quarry GW | | |

## General Chemistry

| Analyte | Result | RL | Units | DF | Analyzed | By | Method |
|---|---|---|---|---|---|---|---|
| Alkalinity, Total as CaCO3 | 188 | 5.0 | mg/l | 1 | 05/23/19 10:00 | PV | SM 2320B-2011 |
| Chloride | 7.5 | 5.0 | mg/l | 10 | 05/15/19 11:45 | JB | EPA300.0/SW846 9056A |
| Nitrogen, Nitrate | 6.5 | 0.25 | mg/l | 25 | 05/15/19 12:51 | JB | EPA300.0/SW846 9056A |
| Phosphorus, Total | 0.31 | 0.010 | mg/l | 1 | 05/24/19 15:37 | AM | EPA 365.1 |
| Solids, Total Dissolved | 417 | 10 | mg/l | 1 | 05/16/19 | SK | SM 2540C-2011 |
| Sulfate | 95.8 | 5.0 | mg/l | 10 | 05/15/19 11:45 | JB | EPA300.0/SW846 9056A |

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RL = Reporting Limit

SGS North America Inc.

# Report of Analysis

Page 1 of 1

| | | | |
|---|---|---|---|
| **Client Sample ID:** | WELL 1 | | |
| **Lab Sample ID:** | DA15855-1F | **Date Sampled:** | 05/14/19 |
| **Matrix:** | AQ - Groundwater Filtered | **Date Received:** | 05/15/19 |
| | | **Percent Solids:** | n/a |
| **Project:** | Parkdale Quarry GW | | |

## Dissolved Metals Analysis

| Analyte | Result | RL | Units | DF | Prep | Analyzed By | | Method | Prep Method |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | < 100 | 100 | ug/l | 2 | 05/16/19 | 05/16/19 | EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Antimony | < 0.80 | 0.80 | ug/l | 2 | 05/16/19 | 05/16/19 | EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Arsenic | 0.40 | 0.40 | ug/l | 2 | 05/16/19 | 05/16/19 | EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Barium | 20.7 | 4.0 | ug/l | 2 | 05/16/19 | 05/16/19 | EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Cadmium | < 0.20 | 0.20 | ug/l | 2 | 05/16/19 | 05/16/19 | EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Calcium | 75800 | 800 | ug/l | 2 | 05/16/19 | 05/16/19 | EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Chromium | < 4.0 | 4.0 | ug/l | 2 | 05/16/19 | 05/16/19 | EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Cobalt [a] | < 1.0 | 1.0 | ug/l | 5 | 05/16/19 | 05/17/19 | EP | EPA 200.8 [3] | EPA 200.8 [6] |
| Copper | < 4.0 | 4.0 | ug/l | 2 | 05/16/19 | 05/16/19 | EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Iron | 122 | 20 | ug/l | 2 | 05/16/19 | 05/17/19 | EP | EPA 200.8 [3] | EPA 200.8 [6] |
| Lead | < 1.0 | 1.0 | ug/l | 2 | 05/16/19 | 05/16/19 | EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Magnesium | 15100 | 200 | ug/l | 2 | 05/16/19 | 05/16/19 | EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Manganese | 2.9 | 2.0 | ug/l | 2 | 05/16/19 | 05/16/19 | EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Molybdenum | 18.8 | 2.0 | ug/l | 2 | 05/16/19 | 05/16/19 | EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Nickel | < 4.0 | 4.0 | ug/l | 2 | 05/16/19 | 05/16/19 | EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Potassium | 3030 | 400 | ug/l | 2 | 05/16/19 | 05/16/19 | EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Selenium | 3.8 | 0.80 | ug/l | 2 | 05/16/19 | 05/16/19 | EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Silicon | 7640 | 50 | ug/l | 1 | 05/17/19 | 05/18/19 | JR | EPA 200.7 [4] | EPA 200.7 [5] |
| Sodium | 23100 | 1000 | ug/l | 2 | 05/16/19 | 05/16/19 | EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Uranium | 13.7 | 0.40 | ug/l | 2 | 05/16/19 | 05/17/19 | EP | EPA 200.8 [2] | EPA 200.8 [6] |
| Zinc | < 20 | 20 | ug/l | 2 | 05/16/19 | 05/16/19 | EP | EPA 200.8 [1] | EPA 200.8 [6] |

(1) Instrument QC Batch: MA11394
(2) Instrument QC Batch: MA11398
(3) Instrument QC Batch: MA11401
(4) Instrument QC Batch: MA11404
(5) Prep QC Batch: MP28042
(6) Prep QC Batch: MP28044

(a) Elevated detection limit due to dilution required for possible matrix interference.

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RL = Reporting Limit

# Report of Analysis

| | | | |
|---|---|---|---|
| **Client Sample ID:** | WELL 3 PARKDALE | | |
| **Lab Sample ID:** | DA15855-3 | **Date Sampled:** | 05/13/19 |
| **Matrix:** | AQ - Ground Water | **Date Received:** | 05/15/19 |
| | | **Percent Solids:** | n/a |
| **Project:** | Parkdale Quarry GW | | |

## General Chemistry

| Analyte | Result | RL | Units | DF | Analyzed | By | Method |
|---|---|---|---|---|---|---|---|
| Alkalinity, Total as CaCO3 | 168 | 5.0 | mg/l | 1 | 05/23/19 10:00 | PV | SM 2320B-2011 |
| Chloride | 9.9 | 2.5 | mg/l | 5 | 05/15/19 11:58 | JB | EPA300.0/SW846 9056A |
| Nitrogen, Nitrate | 2.6 | 0.25 | mg/l | 25 | 05/15/19 13:04 | JB | EPA300.0/SW846 9056A |
| Phosphorus, Total | 0.41 | 0.010 | mg/l | 1 | 05/24/19 15:38 | AM | EPA 365.1 |
| Solids, Total Dissolved | 318 | 10 | mg/l | 1 | 05/16/19 | SK | SM 2540C-2011 |
| Sulfate | 55.7 | 2.5 | mg/l | 5 | 05/15/19 11:58 | JB | EPA300.0/SW846 9056A |

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RL = Reporting Limit

# Report of Analysis

**Client Sample ID:** WELL 3 PARKDALE
**Lab Sample ID:** DA15855-3F
**Matrix:** AQ - Groundwater Filtered
**Date Sampled:** 05/13/19
**Date Received:** 05/15/19
**Percent Solids:** n/a
**Project:** Parkdale Quarry GW

## Dissolved Metals Analysis

| Analyte | Result | RL | Units | DF | Prep | Analyzed By | Method | Prep Method |
|---|---|---|---|---|---|---|---|---|
| Aluminum | < 100 | 100 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Antimony | < 0.80 | 0.80 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Arsenic | 0.43 | 0.40 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Barium | 18.9 | 4.0 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Cadmium | < 0.20 | 0.20 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Calcium | 48100 | 800 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Chromium | < 4.0 | 4.0 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Cobalt | < 0.40 | 0.40 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Copper | < 4.0 | 4.0 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Iron | 82.2 | 20 | ug/l | 2 | 05/16/19 | 05/17/19 EP | EPA 200.8 [3] | EPA 200.8 [6] |
| Lead | < 1.0 | 1.0 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Magnesium | 10600 | 200 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Manganese | 12.8 | 2.0 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Molybdenum | 155 | 2.0 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Nickel | 11.2 | 4.0 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Potassium | 2130 | 400 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Selenium | 2.2 | 0.80 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Silicon | 10700 | 50 | ug/l | 1 | 05/17/19 | 05/18/19 JR | EPA 200.7 [4] | EPA 200.7 [5] |
| Sodium | 28200 | 1000 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Uranium | 19.7 | 0.40 | ug/l | 2 | 05/16/19 | 05/17/19 EP | EPA 200.8 [2] | EPA 200.8 [6] |
| Zinc | < 20 | 20 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |

(1) Instrument QC Batch: MA11394
(2) Instrument QC Batch: MA11398
(3) Instrument QC Batch: MA11401
(4) Instrument QC Batch: MA11404
(5) Prep QC Batch: MP28042
(6) Prep QC Batch: MP28044

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RL = Reporting Limit

# Report of Analysis

| | | | |
|---|---|---|---|
| **Client Sample ID:** | WELL 10 | | |
| **Lab Sample ID:** | DA15855-5 | **Date Sampled:** | 05/13/19 |
| **Matrix:** | AQ - Ground Water | **Date Received:** | 05/15/19 |
| | | **Percent Solids:** | n/a |
| **Project:** | Parkdale Quarry GW | | |

## General Chemistry

| Analyte | Result | RL | Units | DF | Analyzed | By | Method |
|---|---|---|---|---|---|---|---|
| Alkalinity, Total as CaCO3 | 228 | 5.0 | mg/l | 1 | 05/23/19 10:00 | PV | SM 2320B-2011 |
| Chloride | 7.5 | 2.5 | mg/l | 5 | 05/15/19 12:38 | JB | EPA300.0/SW846 9056A |
| Nitrogen, Nitrate | 0.087 | 0.050 | mg/l | 5 | 05/15/19 12:38 | JB | EPA300.0/SW846 9056A |
| Phosphorus, Total | 0.81 | 0.010 | mg/l | 1 | 05/24/19 15:40 | AM | EPA 365.1 |
| Solids, Total Dissolved | 420 | 10 | mg/l | 1 | 05/16/19 | SK | SM 2540C-2011 |
| Sulfate | 85.9 | 2.5 | mg/l | 5 | 05/15/19 12:38 | JB | EPA300.0/SW846 9056A |

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RL = Reporting Limit

SGS North America Inc.

# Report of Analysis

Page 1 of 1

**Client Sample ID:** WELL 10
**Lab Sample ID:** DA15855-5F
**Matrix:** AQ - Groundwater Filtered
**Date Sampled:** 05/13/19
**Date Received:** 05/15/19
**Percent Solids:** n/a
**Project:** Parkdale Quarry GW

## Dissolved Metals Analysis

| Analyte | Result | RL | Units | DF | Prep | Analyzed By | Method | Prep Method |
|---|---|---|---|---|---|---|---|---|
| Aluminum | < 100 | 100 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Antimony | < 0.80 | 0.80 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Arsenic | 0.40 | 0.40 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Barium | 34.0 | 4.0 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Cadmium | < 0.20 | 0.20 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Calcium | 76400 | 800 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Chromium | < 4.0 | 4.0 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Cobalt [a] | < 2.0 | 2.0 | ug/l | 10 | 05/16/19 | 05/17/19 EP | EPA 200.8 [3] | EPA 200.8 [6] |
| Copper | 5.2 | 4.0 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Iron | 140 | 20 | ug/l | 2 | 05/16/19 | 05/17/19 EP | EPA 200.8 [3] | EPA 200.8 [6] |
| Lead | < 1.0 | 1.0 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Magnesium | 14800 | 200 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Manganese | 5.0 | 2.0 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Molybdenum | 7.3 | 2.0 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Nickel | < 4.0 | 4.0 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Potassium | 1640 | 400 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Selenium | 1.2 | 0.80 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Silicon | 13200 | 50 | ug/l | 1 | 05/17/19 | 05/18/19 JR | EPA 200.7 [4] | EPA 200.7 [5] |
| Sodium | 20000 | 1000 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |
| Uranium | 16.7 | 0.40 | ug/l | 2 | 05/16/19 | 05/17/19 EP | EPA 200.8 [2] | EPA 200.8 [6] |
| Zinc | < 20 | 20 | ug/l | 2 | 05/16/19 | 05/16/19 EP | EPA 200.8 [1] | EPA 200.8 [6] |

(1) Instrument QC Batch: MA11394
(2) Instrument QC Batch: MA11398
(3) Instrument QC Batch: MA11401
(4) Instrument QC Batch: MA11404
(5) Prep QC Batch: MP28042
(6) Prep QC Batch: MP28044

(a) Elevated detection limit due to dilution required for possible matrix interference.

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RL = Reporting Limit

## Misc. Forms

# Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

SGS

# CHAIN OF CUSTODY

4036 Youngfield Street, Wheat Ridge, CO 80033
TEL: 303-425-6021 FAX: 303-425-6854
www.accutest.com

Page ___ of ___

Bottle Order Control #
FED-EX Tracking #
SGS Quote #
**SGS Job #** DA15855

**Client / Reporting Information**

Company: ERM-West Inc
Street: 555 17th St, #1700
City, State: Denver, CO
Project Contact: Zack Walter
Phone: 303-741-5050
Email: zack.walter@erm.com
Sampler(s) Name(s): Z Walter, M. Farmer

**Project Information**

Project Name: Parkdale Quarry GW
Street:
City, State:
Project #: 0488586
Client Purchase Order #:
Project Manager: Becky Moore

**Billing Information (if different from Report to)**

Company: ermwestaccounts recievable@erm.com
Street Address:
City, State ZIP:
Attention:

**Requested Analysis (see TEST CODE sheet)**

| Field ID / Point of Collection | Date | Time | Sampled by | Matrix | # of bottles | NONE | HCl | NaOH | HNO3 | H2SO4 | DI Water | MEOH | ENCORE | Na2S2O3 | Na2SO3 | Alkalinity (Sm 2320B-2011) | Dissolved Metals Lf (EPA 200.8 | SO4, NO3, CHL (EPA 300.0) | TDS (SM4500-PE-2011) | Total PO4 (Sm 4500-PE-2011 | Isotopic Uranium | Gross Alpha/Beta + total | Radium 226 | Radium 228 | LAB USE ONLY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Well 1 | 5/14/19 | 1300 | ZW | GW | 12 | 5 | | | 6 | 1 | | | | | | X | X | X | X | X | X | X | X | X | 01 |
| Well 1 Dup | 5/14/19 | 1300 | | | 12 | 5 | | | 6 | 1 | | | | | | Hold PENDING ANALYSIS | | | | | | | | | 02 |
| Well 3 Parkdale | 5/13/19 | 1320 | | | 12 | 5 | | | 6 | 1 | | | | | | X | X | X | X | X | X | X | X | X | 03 |
| Well 3 Parkdale DUP | 5/13/19 | 1320 | | | 12 | 5 | | | 6 | 1 | | | | | | HOLD | | | | | | | | | 04 |
| Well 10 | 5/13/19 | 1630 | | | 12 | 5 | | | 6 | 1 | | | | | | X | X | X | X | X | X | X | X | X | 05 |
| Well 10 Dup | 5/13/19 | 1630 | | | 12 | 5 | | | 6 | 1 | | | | | | HOLD | | | | | | | | | 06 |

**Matrix Codes**

DW - Drinking Water
GW - Ground Water
WW - Water
SW - Surface Water
SO - Soil
SL- Sludge
SED-Sediment
OI - Oil
LIQ - Other Liquid
AIR - Air
SOL - Other Solid
WP - Wipe
FB-Field Blank
EB-Equipment Blank
RB- Rinse Blank
TB-Trip Blank

**Turnaround Time (Business days)**

☒ Std. 10 Business Days
☐ 5 Day RUSH
☐ 3 Day Emergency
☐ 2 Day Emergency
☐ 1 Day Emergency

Emergency & Rush T/A data available VIA LabLink. RUSH TAT approval needed.

**Special Reporting Instructions**

☐ Report in PPB
☐ Report in PPM
☐ Report MDLs

**Data Deliverable Information**

☐ Commercial "A" (Level 1, Results Only)
☒ Commercial "B" (Level 2, Results + QC Summary)
☐ COMMBN (Results/QC/Narrative)
☐ COMMBN+ [Results/QC/Narrative (+ chromatograms)]
☐ REDT2
☐ FULT1
☐ EDD Format ___________

**Comments / Special Instructions**

**Sample Custody must be documented below each time samples change possession, including courier delivery.**

| | | | | | |
|---|---|---|---|---|---|
| Relinquished by Sampler: 1 | Date/Time: 5/15/2019 08:05 | Received By: 1 | 5/15/19 | Relinquished By: 2 | 08:05 | Date/Time: | Received By: 2 |
| Relinquished by Sampler: 3 | Date/Time: | Received By: 3 | Relinquished By: 4 | Date/Time: | Received By: 4 |

Custody Seal # Intact ☑ Not Intact ☐ Absent ☐
Preserved where applicable ☑ N
Cooler Temp. °C: 2.2 Therm. ID: T196
On Ice ☑

Form MSQA 064-01, RV 6/19/17
http://www.sgs.com/terms-and-conditions

# SGS Accutest Sample Receipt Summary

**Job Number:** DA15855 **Client:** ERM **Project:** PARKDALE

**Date / Time Received:** 5/15/2019 8:05:00 AM **Delivery Method:** **Airbill #'s:** HD

**Cooler Temps (Initial/Adjusted):** #1: (2.2/2.2);

| **Cooler Security** | **Y** | **N** | | **Y** | **N** |
|---|---|---|---|---|---|
| 1. Custody Seals Present: | ☑ | ☐ | 3. COC Present: | ☑ | ☐ |
| 2. Custody Seals Intact: | ☑ | ☐ | 4. Smpl Dates/Time OK | ☑ | ☐ |

| **Cooler Temperature** | **Y** | **N** |
|---|---|---|
| 1. Temp criteria achieved: | ☑ | ☐ |
| 2. Cooler temp verification: | Bar Therm; | |
| 3. Cooler media: | Ice (Bag) | |
| 4. No. Coolers: | 1 | |

| **Quality Control Preservation** | **Y** | **N** | **N/A** |
|---|---|---|---|
| 1. Trip Blank present / cooler: | ☐ | ☐ | ☑ |
| 2. Trip Blank listed on COC: | ☐ | ☐ | ☑ |
| 3. Samples preserved properly: | ☑ | ☐ | |
| 4. VOCs headspace free: | ☐ | ☐ | ☑ |

| **Sample Integrity - Documentation** | **Y** | **N** |
|---|---|---|
| 1. Sample labels present on bottles: | ☑ | ☐ |
| 2. Container labeling complete: | ☑ | ☐ |
| 3. Sample container label / COC agree: | ☑ | ☐ |

| **Sample Integrity - Condition** | **Y** | **N** |
|---|---|---|
| 1. Sample recvd within HT: | ☑ | ☐ |
| 2. All containers accounted for: | ☑ | ☐ |
| 3. Condition of sample: | Intact | |

| **Sample Integrity - Instructions** | **Y** | **N** | **N/A** |
|---|---|---|---|
| 1. Analysis requested is clear: | ☑ | ☐ | |
| 2. Bottles received for unspecified tests | ☐ | ☑ | |
| 3. Sufficient volume recvd for analysis: | ☑ | ☐ | |
| 4. Compositing instructions clear: | ☐ | ☐ | ☑ |
| 5. Filtering instructions clear: | ☐ | ☐ | ☑ |

Comments

DA15855: Chain of Custody
Page 2 of 2

Section 6

# Metals Analysis

## QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Matrix Spike and Duplicate Summaries
- Blank Spike and Lab Control Sample Summaries
- Serial Dilution Summaries

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: DA15855
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28042
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 05/17/19

| Metal | RL | IDL | MDL | MB raw | final |
|---|---|---|---|---|---|
| Aluminum | 100 | 46 | 30 | | |
| Antimony | 30 | 14 | 10 | | |
| Arsenic | 25 | 22 | 7 | | |
| Barium | 10 | .3 | 2 | | |
| Beryllium | 10 | 1 | 1.3 | | |
| Boron | 50 | 3.3 | 7.4 | | |
| Cadmium | 10 | 1.9 | 1.6 | | |
| Calcium | 400 | 6.6 | 53 | | |
| Chromium | 10 | 1.1 | 1.7 | | |
| Cobalt | 5.0 | 2.7 | 2.3 | | |
| Copper | 10 | 4.6 | 2.3 | | |
| Iron | 10 | 8.9 | 3.1 | | |
| Lead | 50 | 13 | 6.3 | | |
| Lithium | 5.0 | .6 | 4 | | |
| Magnesium | 200 | 50 | 31 | | |
| Manganese | 5.0 | .5 | 1.1 | | |
| Molybdenum | 10 | 8.5 | 4.3 | | |
| Nickel | 30 | 6.2 | 6.1 | | |
| Phosphorus | 100 | 91 | 24 | | |
| Potassium | 1000 | 84 | 250 | | |
| Selenium | 50 | 30 | 21 | | |
| Silicon | 50 | 41 | 45 | 48.9 | * (a) |
| Silver | 30 | .6 | 4 | | |
| Sodium | 400 | 13 | 51 | | |
| Strontium | 5.0 | .1 | .6 | | |
| Thallium | 10 | 17 | 7.5 | | |
| Tin | 60 | 41 | 51 | | |
| Titanium | 10 | .5 | 1.9 | | |
| Uranium | 50 | 3.9 | 8.5 | | |
| Vanadium | 10 | .9 | .7 | | |
| Zinc | 30 | 9 | 3.8 | | |

Associated samples MP28042: DA15855-1F, DA15855-3F, DA15855-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: DA15855
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28042
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 05/17/19

| Metal | RL | IDL | MDL | MB raw | final |
|---|---|---|---|---|---|

(anr) Analyte not requested
(a) All sample results >10x method blank concentration.

# MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA15855
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28042
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 05/17/19

| Metal | DA15903-1F Original | MS | Spikelot ICPALL2 | % Rec | QC Limits |
|---|---|---|---|---|---|
| Aluminum | | | | | |
| Antimony | | | | | |
| Arsenic | | | | | |
| Barium | | | | | |
| Beryllium | | | | | |
| Boron | anr | | | | |
| Cadmium | | | | | |
| Calcium | anr | | | | |
| Chromium | | | | | |
| Cobalt | | | | | |
| Copper | | | | | |
| Iron | anr | | | | |
| Lead | | | | | |
| Lithium | | | | | |
| Magnesium | anr | | | | |
| Manganese | anr | | | | |
| Molybdenum | | | | | |
| Nickel | | | | | |
| Phosphorus | | | | | |
| Potassium | anr | | | | |
| Selenium | | | | | |
| Silicon | 27000 | 27700 | 1000 | 70.0 | 70-130 |
| Silver | | | | | |
| Sodium | anr | | | | |
| Strontium | anr | | | | |
| Thallium | | | | | |
| Tin | | | | | |
| Titanium | | | | | |
| Uranium | | | | | |
| Vanadium | | | | | |
| Zinc | | | | | |

Associated samples MP28042: DA15855-1F, DA15855-3F, DA15855-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA15855
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28042
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 05/17/19

| Metal | DA15903-1F<br>Original | MS | Spikelot<br>ICPALL2 | % Rec | QC<br>Limits |
|---|---|---|---|---|---|

(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA15855
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28042
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 05/17/19

| Metal | DA15903-1F Original | MSD | Spikelot ICPALL2 | % Rec | MSD RPD | QC Limit |
|---|---|---|---|---|---|---|
| Aluminum | | | | | | |
| Antimony | | | | | | |
| Arsenic | | | | | | |
| Barium | | | | | | |
| Beryllium | | | | | | |
| Boron | anr | | | | | |
| Cadmium | | | | | | |
| Calcium | anr | | | | | |
| Chromium | | | | | | |
| Cobalt | | | | | | |
| Copper | | | | | | |
| Iron | anr | | | | | |
| Lead | | | | | | |
| Lithium | | | | | | |
| Magnesium | anr | | | | | |
| Manganese | anr | | | | | |
| Molybdenum | | | | | | |
| Nickel | | | | | | |
| Phosphorus | | | | | | |
| Potassium | anr | | | | | |
| Selenium | | | | | | |
| Silicon | 27000 | 27600 | 1000 | 60.0 (a) | 0.4 | 20 |
| Silver | | | | | | |
| Sodium | anr | | | | | |
| Strontium | anr | | | | | |
| Thallium | | | | | | |
| Tin | | | | | | |
| Titanium | | | | | | |
| Uranium | | | | | | |
| Vanadium | | | | | | |
| Zinc | | | | | | |

Associated samples MP28042: DA15855-1F, DA15855-3F, DA15855-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA15855
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28042
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 05/17/19

| Metal | DA15903-1F<br>Original MSD | Spikelot<br>ICPALL2 | % Rec | MSD<br>RPD | QC<br>Limit |
|---|---|---|---|---|---|

(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested
(a) Spike amount low relative to the sample amount. Refer to lab control or spike blank for recovery information.

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: DA15855
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28042
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 05/17/19

| Metal | BSP Result | Spikelot ICPALL2 | % Rec | QC Limits |
|---|---|---|---|---|
| Aluminum | | | | |
| Antimony | | | | |
| Arsenic | | | | |
| Barium | | | | |
| Beryllium | | | | |
| Boron | anr | | | |
| Cadmium | | | | |
| Calcium | anr | | | |
| Chromium | | | | |
| Cobalt | | | | |
| Copper | | | | |
| Iron | anr | | | |
| Lead | | | | |
| Lithium | | | | |
| Magnesium | anr | | | |
| Manganese | anr | | | |
| Molybdenum | | | | |
| Nickel | | | | |
| Phosphorus | | | | |
| Potassium | anr | | | |
| Selenium | | | | |
| Silicon | 1070 | 1000 | 107.0 | 85-115 |
| Silver | | | | |
| Sodium | anr | | | |
| Strontium | anr | | | |
| Thallium | | | | |
| Tin | | | | |
| Titanium | | | | |
| Uranium | | | | |
| Vanadium | | | | |
| Zinc | | | | |

Associated samples MP28042: DA15855-1F, DA15855-3F, DA15855-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: DA15855
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28042
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 05/17/19

| Metal | BSP Result | Spikelot ICPALL2 | % Rec | QC Limits |
|---|---|---|---|---|

(anr) Analyte not requested

# BLANK RESULTS SUMMARY
## Part 2 - Method Blanks

Login Number: DA15855
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28044
Matrix Type: AQUEOUS

Methods: EPA 200.8
Units: ug/l

Prep Date: 05/16/19

| Metal | RL | IDL | MDL | MB<br>raw | final |
|---|---|---|---|---|---|
| Aluminum | 50 | 1.1 | 2 | 5.2 | <50 |
| Antimony | 0.40 | .0022 | .011 | 0.0060 | <0.40 |
| Arsenic | 0.20 | .017 | .044 | 0.0060 | <0.20 |
| Barium | 2.0 | .016 | .079 | 0.073 | <2.0 |
| Beryllium | 0.20 | .016 | .069 | | |
| Boron | 40 | .49 | 2.1 | | |
| Cadmium | 0.10 | .036 | .042 | -0.032 | <0.10 |
| Calcium | 400 | 5.6 | 12 | 29.0 | <400 |
| Chromium | 2.0 | .053 | .053 | 0.16 | <2.0 |
| Cobalt | 0.20 | .0049 | .015 | 0.0030 | <0.20 |
| Copper | 2.0 | .06 | .13 | 0.089 | <2.0 |
| Iron | 10 | 3.5 | 4.6 | 5.3 | * (a) |
| Lead | 0.50 | .0079 | .008 | 0.041 | <0.50 |
| Magnesium | 100 | 1.3 | 1.3 | 7.9 | <100 |
| Manganese | 1.0 | .12 | .13 | 0.12 | <1.0 |
| Molybdenum | 1.0 | .049 | .029 | 0.011 | <1.0 |
| Nickel | 2.0 | .0088 | .027 | 0.029 | <2.0 |
| Phosphorus | 60 | 2.6 | 4.3 | | |
| Potassium | 200 | 2.9 | 2.9 | 2.3 | <200 |
| Selenium | 0.40 | .06 | .21 | -0.052 | <0.40 |
| Silver | 0.10 | .0019 | .008 | | |
| Sodium | 500 | 4.9 | 4.9 | 21.2 | <500 |
| Strontium | 20 | .01 | .015 | | |
| Thallium | 0.20 | .0024 | .005 | | |
| Tin | 10 | .063 | 1.3 | | |
| Titanium | 2.0 | .059 | .092 | | |
| Uranium | 0.20 | .0017 | .002 | 0.073 | <0.20 |
| Vanadium | 1.0 | .037 | .2 | | |
| Zinc | 10 | .21 | .96 | 2.0 | <10 |

Associated samples MP28044: DA15855-1F, DA15855-3F, DA15855-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested
(a) All sample results < RL or > 10x MB concentration.

# MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA15855
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28044
Matrix Type: AQUEOUS

Methods: EPA 200.8
Units: ug/l

Prep Date: 05/16/19

| Metal | DA15925-1A<br>Original | MS | Spikelot<br>ICPALL2 | % Rec | QC<br>Limits |
|---|---|---|---|---|---|
| Aluminum | 476 | 2180 | 2000 | 85.2 | 70-130 |
| Antimony | 0.86 | 195 | 100 | 97.0 | 70-130 |
| Arsenic | 1.8 | 379 | 400 | 94.3 | 70-130 |
| Barium | 108 | 892 | 800 | 98.0 | 70-130 |
| Beryllium | | | | | |
| Boron | | | | | |
| Cadmium | 0.21 | 196 | 200 | 97.9 | 70-130 |
| Calcium | 111000 | 106000 | 10000 | 74.0 | 70-130 |
| Chromium | 25.5 | 216 | 200 | 95.3 | 70-130 |
| Cobalt | 0.0 | 187 | 200 | 93.5 | 70-130 |
| Copper | 63.3 | 239 | 200 | 87.9 | 70-130 |
| Iron | 976 | 2900 | 2000 | 96.2 | 70-130 |
| Lead | 1.8 | 399 | 400 | 99.3 | 70-130 |
| Magnesium | 45800 | 53500 | 10000 | 77.0 | 70-130 |
| Manganese | 123 | 310 | 200 | 93.5 | 70-130 |
| Molybdenum | 12.3 | 218 | 200 | 102.9 | 70-130 |
| Nickel | 13.4 | 193 | 200 | 89.8 | 70-130 |
| Phosphorus | | | | | |
| Potassium | 18100 | 27400 | 10000 | 93.0 | 70-130 |
| Selenium | 3.2 | 357 | 400 | 88.5 | 70-130 |
| Silver | | | | | |
| Sodium | 256000 | 262000 | 10000 | -20.0(a) | 70-130 |
| Strontium | | | | | |
| Thallium | | | | | |
| Tin | | | | | |
| Titanium | | | | | |
| Uranium | 12.8 | 461 | 400 | 112.1 | 70-130 |
| Vanadium | | | | | |
| Zinc | 131 | 293 | 200 | 81.0 | 70-130 |

Associated samples MP28044: DA15855-1F, DA15855-3F, DA15855-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested
(a) Spike amount low relative to the sample amount. Refer to lab control or spike blank for recovery information.

# MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: DA15855
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28044
Matrix Type: AQUEOUS

Methods: EPA 200.8
Units: ug/l

Prep Date: 05/16/19

| | DA15925-1A | | Spikelot | | MSD | QC |
|---|---|---|---|---|---|---|
| Metal | Original | MSD | ICPALL2 | % Rec | RPD | Limit |
| Aluminum | 476 | 2160 | 2000 | 84.2 | 0.9 | 20 |
| Antimony | 0.86 | 198 | 100 | 98.6 | 1.5 | 20 |
| Arsenic | 1.8 | 372 | 400 | 92.6 | 1.9 | 20 |
| Barium | 108 | 919 | 800 | 101.4 | 3.0 | 20 |
| Beryllium | | | | | | |
| Boron | | | | | | |
| Cadmium | 0.21 | 198 | 200 | 98.9 | 1.0 | 20 |
| Calcium | 111000 | 105000 | 10000 | 64.0 (a) | 1.4 | 20 |
| Chromium | 25.5 | 214 | 200 | 94.3 | 0.9 | 20 |
| Cobalt | 0.0 | 191 | 200 | 95.5 | 2.1 | 20 |
| Copper | 63.3 | 243 | 200 | 89.9 | 1.7 | 20 |
| Iron | 976 | 2750 | 2000 | 88.7 | 5.3 | 20 |
| Lead | 1.8 | 403 | 400 | 100.3 | 1.0 | 20 |
| Magnesium | 45800 | 53000 | 10000 | 72.0 | 0.9 | 20 |
| Manganese | 123 | 309 | 200 | 93.0 | 0.3 | 20 |
| Molybdenum | 12.3 | 221 | 200 | 104.4 | 1.4 | 20 |
| Nickel | 13.4 | 195 | 200 | 90.8 | 1.0 | 20 |
| Phosphorus | | | | | | |
| Potassium | 18100 | 27100 | 10000 | 90.0 | 1.1 | 20 |
| Selenium | 3.2 | 355 | 400 | 88.0 | 0.6 | 20 |
| Silver | | | | | | |
| Sodium | 256000 | 266000 | 10000 | 20.0 (a) | 1.5 | 20 |
| Strontium | | | | | | |
| Thallium | | | | | | |
| Tin | | | | | | |
| Titanium | | | | | | |
| Uranium | 12.8 | 455 | 400 | 110.6 | 1.6 | 20 |
| Vanadium | | | | | | |
| Zinc | 131 | 291 | 200 | 80.0 | 0.7 | 20 |

Associated samples MP28044: DA15855-1F, DA15855-3F, DA15855-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested
(a) Spike amount low relative to the sample amount. Refer to lab control or spike blank for recovery information.

# SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: DA15855
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

QC Batch ID: MP28044
Matrix Type: AQUEOUS

Methods: EPA 200.8
Units: ug/l

Prep Date: 05/16/19

| Metal | BSP Result | Spikelot ICPALL2 | % Rec | QC Limits |
|---|---|---|---|---|
| Aluminum | 925 | 1000 | 92.5 | 85-115 |
| Antimony | 103 | 100 | 103.0 | 85-115 |
| Arsenic | 204 | 200 | 102.0 | 85-115 |
| Barium | 394 | 400 | 98.5 | 85-115 |
| Beryllium | | | | |
| Boron | | | | |
| Cadmium | 104 | 100 | 104.0 | 85-115 |
| Calcium | 5130 | 5000 | 102.6 | 85-115 |
| Chromium | 102 | 100 | 102.0 | 85-115 |
| Cobalt | 102 | 100 | 102.0 | 85-115 |
| Copper | 99.7 | 100 | 99.7 | 85-115 |
| Iron | 996 | 1000 | 99.6 | 85-115 |
| Lead | 203 | 200 | 101.5 | 85-115 |
| Magnesium | 5040 | 5000 | 100.8 | 85-115 |
| Manganese | 103 | 100 | 103.0 | 85-115 |
| Molybdenum | 100 | 100 | 100.0 | 85-115 |
| Nickel | 99.1 | 100 | 99.1 | 85-115 |
| Phosphorus | | | | |
| Potassium | 5120 | 5000 | 102.4 | 85-115 |
| Selenium | 201 | 200 | 100.5 | 85-115 |
| Silver | | | | |
| Sodium | 5040 | 5000 | 100.8 | 85-115 |
| Strontium | | | | |
| Thallium | | | | |
| Tin | | | | |
| Titanium | | | | |
| Uranium | 205 | 200 | 102.5 | 85-115 |
| Vanadium | | | | |
| Zinc | 99.5 | 100 | 99.5 | 85-115 |

Associated samples MP28044: DA15855-1F, DA15855-3F, DA15855-5F

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

## General Chemistry

## QC Data Summaries

Includes the following where applicable:

- Method Blank and Blank Spike Summaries
- Duplicate Summaries
- Matrix Spike Summaries

METHOD BLANK AND SPIKE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: DA15855
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

| Analyte | Batch ID | RL | MB Result | Units | Spike Amount | BSP Result | BSP %Recov | QC Limits |
|---|---|---|---|---|---|---|---|---|
| Alkalinity, Total as CaCO3 | GN47063 | 5.0 | 2.2 | mg/l | 100 | 101 | 100.5 | 90-110% |
| Bromide | GP25118/GN46966 | 0.050 | 0.0 | mg/l | 0.5 | 0.516 | 103.2 | 90-110% |
| Chloride | GP25118/GN46966 | 0.50 | 0.0 | mg/l | 5 | 5.29 | 105.8 | 90-110% |
| Fluoride | GP25118/GN46966 | 0.10 | 0.0 | mg/l | 1 | 1.05 | 105.0 | 90-110% |
| Nitrogen, Nitrate | GP25118/GN46966 | 0.010 | 0.0 | mg/l | 0.1 | 0.102 | 102.0 | 90-110% |
| Nitrogen, Nitrite | GP25118/GN46966 | 0.0040 | 0.0 | mg/l | 0.05 | 0.0505 | 101.0 | 90-110% |
| Phosphorus, Total | GP25206/GN47082 | 0.010 | 0.00 | mg/l | 0.2 | 0.190 | 95.0 | 90-110% |
| Phosphorus, Total | GP25206/GN47082 | 0.010 | 0.00 | mg/l | 0.2 | 0.188 | 94.0 | 90-110% |
| Solids, Total Dissolved | GN46967 | 10 | 0.0 | mg/l | 400 | 401 | 100.3 | 90-110% |
| Sulfate | GP25118/GN46966 | 0.50 | 0.0 | mg/l | 5 | 5.13 | 102.6 | 90-110% |

Associated Samples:
Batch GN46967: DA15855-1, DA15855-3, DA15855-5
Batch GN47063: DA15855-1, DA15855-3, DA15855-5
Batch GP25118: DA15855-1, DA15855-3, DA15855-5
Batch GP25206: DA15855-1, DA15855-3, DA15855-5
(*) Outside of QC limits

DUPLICATE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: DA15855
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

| Analyte | Batch ID | QC Sample | Units | Original Result | DUP Result | RPD | QC Limits |
|---|---|---|---|---|---|---|---|
| Alkalinity, Total as CaCO3 | GN47063 | DA16000-1 | mg/l | 604 | 607 | 0.5 | 0-20% |
| Phosphorus, Total | GP25206/GN47082 | DA15986-1 | mg/l | 0.017 | 0.0210 | 21.1(a) | 0-20% |
| Solids, Total Dissolved | GN46967 | DA15829-1 | mg/l | 1950 | 1940 | 0.5 | 0-5% |

Associated Samples:
Batch GN46967: DA15855-1, DA15855-3, DA15855-5
Batch GN47063: DA15855-1, DA15855-3, DA15855-5
Batch GP25206: DA15855-1, DA15855-3, DA15855-5
(*) Outside of QC limits
(a) RPD acceptable due to low duplicate and sample concentrations.

MATRIX SPIKE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: DA15855
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

| Analyte | Batch ID | QC Sample | Units | Original Result | Spike Amount | MS Result | %Rec | QC Limits |
|---|---|---|---|---|---|---|---|---|
| Alkalinity, Total as CaCO3 | GN47063 | DA15692-4 | mg/l | 64.3 | 100 | 162 | 97.9 | 80-120% |
| Bromide | GP25118/GN46966 | DA15856-3 | mg/l | 0.0 | 0.5 | 0.51 | 102.0 | 80-120% |
| Chloride | GP25118/GN46966 | DA15856-3 | mg/l | 0.58 | 5 | 5.7 | 102.4 | 80-120% |
| Fluoride | GP25118/GN46966 | DA15856-3 | mg/l | 0.074 | 1 | 1.1 | 102.6 | 80-120% |
| Nitrogen, Nitrate | GP25118/GN46966 | DA15856-3 | mg/l | 0.028 | 0.1 | 0.13 | 102.0 | 80-120% |
| Nitrogen, Nitrite | GP25118/GN46966 | DA15856-3 | mg/l | 0.0 | 0.05 | 0.051 | 102.0 | 80-120% |
| Phosphorus, Total | GP25206/GN47082 | DA16059-1 | mg/l | 0.094 | 0.2 | 0.289 | 97.5 | 90-110% |
| Sulfate | GP25118/GN46966 | DA15856-3 | mg/l | 1.8 | 5 | 6.8 | 100.0 | 80-120% |

Associated Samples:
Batch GN47063: DA15855-1, DA15855-3, DA15855-5
Batch GP25118: DA15855-1, DA15855-3, DA15855-5
Batch GP25206: DA15855-1, DA15855-3, DA15855-5
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits

MATRIX SPIKE DUPLICATE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: DA15855
Account: ERMCOGV - ERM-West, Inc.
Project: Parkdale Quarry GW

| Analyte | Batch ID | QC Sample | Units | Original Result | Spike Amount | MSD Result | RPD | QC Limit |
|---|---|---|---|---|---|---|---|---|
| Alkalinity, Total as CaCO3 | GN47063 | DA15692-4 | mg/l | 64.3 | 100 | 160 | 1.1 | 20% |
| Bromide | GP25118/GN46966 | DA15856-3 | mg/l | 0.0 | 0.5 | 0.51 | 0.0 | 20% |
| Chloride | GP25118/GN46966 | DA15856-3 | mg/l | 0.58 | 5 | 5.7 | 0.0 | 20% |
| Fluoride | GP25118/GN46966 | DA15856-3 | mg/l | 0.074 | 1 | 1.1 | 0.0 | 20% |
| Nitrogen, Nitrate | GP25118/GN46966 | DA15856-3 | mg/l | 0.028 | 0.1 | 0.13 | 0.0 | 20% |
| Nitrogen, Nitrite | GP25118/GN46966 | DA15856-3 | mg/l | 0.0 | 0.05 | 0.051 | 0.0 | 20% |
| Sulfate | GP25118/GN46966 | DA15856-3 | mg/l | 1.8 | 5 | 6.8 | 0.0 | 20% |

Associated Samples:
Batch GN47063: DA15855-1, DA15855-3, DA15855-5
Batch GP25118: DA15855-1, DA15855-3, DA15855-5
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits

**ACZ Laboratories, Inc.**
*2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493*

# Analytical Report

June 12, 2019

| Report to: | Bill to: |
|---|---|
| Scott Heideman | Scott Heideman |
| SGS Accutest | SGS Accutest |
| 4036 Youngfield Street | 4036 Youngfield Street |
| Wheat Ridge, CO 80033 | Wheat Ridge, CO 80033 |

cc: Scott Heideman, Janel Mulholland, Elizabeth Sutcliffe

Project ID:
ACZ Project ID: L51823

Scott Heideman:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on May 16, 2019. This project has been assigned to ACZ's project number, L51823. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L51823. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after July 12, 2019. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

Bill P. Lane

Bill Lane has reviewed and
approved this report

**SGS Accutest**
Project ID:
Sample ID: DA15855-1X

ACZ Sample ID: ***L51823-01***
Date Sampled: *05/14/19 13:00*
Date Received: *05/16/19*
Sample Matrix: *Waste Water*

Wet Chemistry

| Parameter | EPA Method | Dilution | Result | Qual | XQ | Units | MDL | PQL | Date | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|
| Residue, Total (TS) @ 105C | SM2540B | 1 | 1110 | | | mg/L | 20 | 40 | 05/20/19 20:02 | nmc |

**Arizona license number: AZ0102**

# Inorganic Analytical Results

**SGS Accutest**
Project ID:
Sample ID: DA15855-3X

ACZ Sample ID: ***L51823-02***
Date Sampled: *05/14/19 13:20*
Date Received: *05/16/19*
Sample Matrix: *Waste Water*

Wet Chemistry

| Parameter | EPA Method | Dilution | Result | Qual | XQ | Units | MDL | PQL | Date | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|
| Residue, Total (TS) @ 105C | SM2540B | 1 | 1300 | | | mg/L | 20 | 40 | 05/20/19 20:04 | nmc |

**Arizona license number: AZ0102**

**SGS Accutest**
Project ID:
Sample ID: DA15855-5X

ACZ Sample ID: ***L51823-03***
Date Sampled: *05/14/19 16:30*
Date Received: *05/16/19*
Sample Matrix: *Waste Water*

Wet Chemistry

| Parameter | EPA Method | Dilution | Result | Qual | XQ | Units | MDL | PQL | Date | Analyst |
|---|---|---|---|---|---|---|---|---|---|---|
| Residue, Total (TS) @ 105C | SM2540B | 1 | 1140 | | | mg/L | 20 | 40 | 05/20/19 20:05 | nmc |

**Arizona license number: AZ0102**

## Report Header Explanations

| | |
|---|---|
| *Batch* | A distinct set of samples analyzed at a specific time |
| *Found* | Value of the QC Type of interest |
| *Limit* | Upper limit for RPD, in %. |
| *Lower* | Lower Recovery Limit, in % (except for LCSS, mg/Kg) |
| *MDL* | Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations. |
| *PCN/SCN* | A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis |
| *PQL* | Practical Quantitation Limit. Synonymous with the EPA term "minimum level". |
| *QC* | True Value of the Control Sample or the amount added to the Spike |
| *Rec* | Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg) |
| *RPD* | Relative Percent Difference, calculation used for Duplicate QC Types |
| *Upper* | Upper Recovery Limit, in % (except for LCSS, mg/Kg) |
| *Sample* | Value of the Sample of interest |

## QC Sample Types

| | | | |
|---|---|---|---|
| *AS* | Analytical Spike (Post Digestion) | *LCSWD* | Laboratory Control Sample - Water Duplicate |
| *ASD* | Analytical Spike (Post Digestion) Duplicate | *LFB* | Laboratory Fortified Blank |
| *CCB* | Continuing Calibration Blank | *LFM* | Laboratory Fortified Matrix |
| *CCV* | Continuing Calibration Verification standard | *LFMD* | Laboratory Fortified Matrix Duplicate |
| *DUP* | Sample Duplicate | *LRB* | Laboratory Reagent Blank |
| *ICB* | Initial Calibration Blank | *MS* | Matrix Spike |
| *ICV* | Initial Calibration Verification standard | *MSD* | Matrix Spike Duplicate |
| *ICSAB* | Inter-element Correction Standard - A plus B solutions | *PBS* | Prep Blank - Soil |
| *LCSS* | Laboratory Control Sample - Soil | *PBW* | Prep Blank - Water |
| *LCSSD* | Laboratory Control Sample - Soil Duplicate | *PQV* | Practical Quantitation Verification standard |
| *LCSW* | Laboratory Control Sample - Water | *SDL* | Serial Dilution |

## QC Sample Type Explanations

| | |
|---|---|
| Blanks | Verifies that there is no or minimal contamination in the prep method or calibration procedure. |
| Control Samples | Verifies the accuracy of the method, including the prep procedure. |
| Duplicates | Verifies the precision of the instrument and/or method. |
| Spikes/Fortified Matrix | Determines sample matrix interferences, if any. |
| Standard | Verifies the validity of the calibration. |

## ACZ Qualifiers (Qual)

| | |
|---|---|
| B | Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity. |
| H | Analysis exceeded method hold time. pH is a field test with an immediate hold time. |
| L | Target analyte response was below the laboratory defined negative threshold. |
| U | The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit. |

## Method References

(1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4) EPA SW-846. Test Methods for Evaluating Solid Waste.
(5) Standard Methods for the Examination of Water and Wastewater.

## Comments

(1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3) Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5) If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click:
https://acz.com/wp-content/uploads/2019/04/Ext-Qual-List.pdf

**SGS Accutest**

ACZ Project ID: ***L51823***

*NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.*

**Residue, Total (TS) @ 105C** SM2540B

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Found | Units | Rec% | Lower | Upper | RPD | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG472736** | | | | | | | | | | | | | |
| WG472736PBW | PBW | 05/20/19 20:00 | | | | 22 | mg/L | | -40 | 40 | | | |
| WG472736LCSW | LCSW | 05/20/19 20:01 | PCN58852 | 1100 | | 1100 | mg/L | 100 | 80 | 120 | | | |
| L51908-01DUP | DUP | 05/20/19 20:16 | | | 234 | 216 | mg/L | | | | 8 | 10 | |

# Inorganic Extended Qualifier Report

**SGS Accutest** ACZ Project ID: ***L51823***

| ACZ ID | WORKNUM | PARAMETER | METHOD | QUAL | DESCRIPTION |
|---|---|---|---|---|---|

No extended qualifiers associated with this analysis

| | | | |
|---|---|---|---|
| **SGS Accutest** | | ACZ Sample ID: | ***L51823-01*** |
| Project ID: | | Date Sampled: | *05/14/19 13:00* |
| Sample ID: | DA15855-1X | Date Received: | *05/16/19* |
| Locator: | | Sample Matrix: | *Waste Water* |

Gross Alpha & Beta

Prep Method:

M900.0

| Parameter | Measure Date | Prep Date | Result | Error(+/ ) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Gross Alpha | 06/03/19 0:00 | | 18 | 5.7 | 11 | pCi/L | | amk |
| Gross Beta | 06/03/19 0:00 | | 28 | 4.8 | 7.3 | pCi/L | | amk |

Radium 226

Prep Method:

M903.1

| Parameter | Measure Date | Prep Date | Result | Error(+/ ) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Radium 226 | 06/10/19 0:17 | | 1.2 | 0.26 | 0.19 | pCi/L | * | djc |

Radium 228, total

Prep Method:

M904.0

| Parameter | Measure Date | Prep Date | Result | Error(+/ ) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Radium 228, total | 06/10/19 13:46 | | 2.7 | 2.8 | 2.8 | pCi/L | * | amk |

Uranium, Isotopic Total

Prep Method:

Eichrom ACW03

| Parameter | Measure Date | Prep Date | Result | Error(+/ ) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Uranium 234, total | 05/30/19 0:21 | | 19 | 4.6 | 2.6 | pCi/L | * | jlg |
| Uranium 235, total | 05/30/19 0:21 | | 0.0 | 1.1 | 4.6 | pCi/L | * | jlg |
| Uranium 238, total | 05/30/19 0:21 | | 6.45 | 2.9 | 2.4 | pCi/L | * | jlg |

**Arizona license number: AZ0102**

| | | | |
|---|---|---|---|
| **SGS Accutest** | | ACZ Sample ID: | ***L51823-02*** |
| Project ID: | | Date Sampled: | *05/14/19 13:20* |
| Sample ID: | DA15855-3X | Date Received: | *05/16/19* |
| Locator: | | Sample Matrix: | *Waste Water* |

Gross Alpha & Beta

M900.0

Prep Method:

| Parameter | Measure Date | Prep Date | Result | Error(+/ ) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Gross Alpha | 06/03/19 0:00 | | 47 | 11 | 18 | pCi/L | | amk |
| Gross Beta | 06/03/19 0:00 | | 65 | 8.2 | 14 | pCi/L | | amk |

Radium 226

M903.1

Prep Method:

| Parameter | Measure Date | Prep Date | Result | Error(+/ ) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Radium 226 | 06/10/19 0:18 | | 1.3 | 0.31 | 0.27 | pCi/L | * | djc |

Radium 228, total

M904.0

Prep Method:

| Parameter | Measure Date | Prep Date | Result | Error(+/ ) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Radium 228, total | 06/04/19 16:35 | | 9.7 | 1.6 | 1.2 | pCi/L | * | amk |

Uranium, Isotopic Total

Eichrom ACW03

Prep Method:

| Parameter | Measure Date | Prep Date | Result | Error(+/ ) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Uranium 234, total | 05/30/19 0:23 | | 17 | 4 | 1.9 | pCi/L | * | jlg |
| Uranium 235, total | 05/30/19 0:23 | | -0.27 | 1.5 | 2.3 | pCi/L | * | jlg |
| Uranium 238, total | 05/30/19 0:23 | | 7.28 | 3 | 2.8 | pCi/L | * | jlg |

**Arizona license number: AZ0102**

**SGS Accutest**
Project ID:
Sample ID: DA15855-5X
Locator:

ACZ Sample ID: ***L51823-03***
Date Sampled: *05/14/19 16:30*
Date Received: *05/16/19*
Sample Matrix: *Waste Water*

Gross Alpha & Beta
M900.0

Prep Method:

| Parameter | Measure Date | Prep Date | Result | Error(+/ ) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Gross Alpha | 06/03/19 0:00 | | 25 | 7.7 | 15 | pCi/L | | amk |
| Gross Beta | 06/03/19 0:00 | | 34 | 6.5 | 14 | pCi/L | | amk |

Radium 226
M903.1

Prep Method:

| Parameter | Measure Date | Prep Date | Result | Error(+/ ) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Radium 226 | 06/10/19 0:20 | | 1.4 | 0.22 | 0.18 | pCi/L | * | djc |

Radium 228, total
M904.0

Prep Method:

| Parameter | Measure Date | Prep Date | Result | Error(+/ ) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Radium 228, total | 06/04/19 16:35 | | 2.6 | 0.79 | 0.71 | pCi/L | | amk |

Uranium, Isotopic Total
Eichrom ACW03

Prep Method:

| Parameter | Measure Date | Prep Date | Result | Error(+/ ) | LLD | Units | XQ | Analyst |
|---|---|---|---|---|---|---|---|---|
| Uranium 234, total | 05/30/19 0:24 | | 11 | 3.2 | 2 | pCi/L | * | jlg |
| Uranium 235, total | 05/30/19 0:24 | | -0.64 | 0.93 | 1.5 | pCi/L | * | jlg |
| Uranium 238, total | 05/30/19 0:24 | | 7.44 | 2.7 | 1.5 | pCi/L | * | jlg |

**Arizona license number: AZ0102**

# Radiochemistry Reference

## Report Header Explanations

| | |
|---|---|
| *Batch* | A distinct set of samples analyzed at a specific time |
| *Error(+/-)* | Calculated sample specific uncertainty |
| *Found* | Value of the QC Type of interest |
| *Limit* | Upper limit for RPD, in %. |
| *LCL* | Lower Control Limit, in % (except for LCSS, mg/Kg) |
| *LLD* | Calculated sample specific Lower Limit of Detection |
| *PCN/SCN* | A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis |
| *PQL* | Practical Quantitation Limit |
| *QC* | True Value of the Control Sample or the amount added to the Spike |
| *Rec* | Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg) |
| *RER* | Relative Error Ratio, calculation used for Dup. QC taking into account the error factor. |
| *RPD* | Relative Percent Difference, calculation used for Duplicate QC Types |
| *UCL* | Upper Control Limit, in % (except for LCSS, mg/Kg) |
| *Sample* | Value of the Sample of interest |

## QC Sample Types

| | | | |
|---|---|---|---|
| *DUP* | Sample Duplicate | *MS/MSD* | Matrix Spike/Matrix Spike Duplicate |
| *LCSS* | Laboratory Control Sample - Soil | *PBS* | Prep Blank - Soil |
| *LCSW* | Laboratory Control Sample - Water | *PBW* | Prep Blank - Water |

## QC Sample Type Explanations

| | |
|---|---|
| Blanks | Verifies that there is no or minimal contamination in the prep method procedure. |
| Control Samples | Verifies the accuracy of the method, including the prep procedure. |
| Duplicates | Verifies the precision of the instrument and/or method. |
| Matrix Spikes | Determines sample matrix interferences, if any. |

## ACZ Qualifiers (Qual)

| | |
|---|---|
| H | Analysis exceeded method hold time. |

## Method Prefix Reference

| | |
|---|---|
| M | EPA methodology, including those under SDWA, CWA, and RCRA |
| SM | Standard Methods for the Examination of Water and Wastewater. |
| D | ASTM |
| RP | DOE |
| ESM | DOE/ESM |

## Comments

| | |
|---|---|
| (1) | Solid matrices are reported on a dry weight basis. |
| (2) | Preparation method: "Method" indicates preparation defined in analytical method. |
| (3) | QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations. |
| (4) | An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result. |

For a complete list of ACZ's Extended Qualifiers, please click:
https://acz.com/wp-content/uploads/2019/04/Ext-Qual-List.pdf

**SGS Accutest** ACZ Project ID: ***L51823***

*NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.*

**Alpha** M900.0 **Units:** pCi/L

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Error | LLD | Found | Error | LLD | Rec% | Lower | Upper | RPD/RER | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG473687** | | | | | | | | | | | | | | | | |
| L51810-02MSA | MS | 06/03/19 | PCN57385 | 100 | 8.4 | 3.2 | 5.4 | 120 | 12 | 7.4 | 112 | 67 | 144 | | | |
| L51851-01DUP | DUP-RER | 06/03/19 | | | 2 | 2 | 5.7 | 1.7 | 1.9 | 5.6 | | | | 0.11 | 2 | |
| WG473104LCSWA | LCSW | 06/03/19 | PCN57385 | 100 | | | | 110 | 8.8 | 1.3 | 110 | 67 | 144 | | | |
| WG473104PBW | PBW | 06/03/19 | | | | | | -.18 | 0.51 | 0.85 | | | 1.7 | | | |
| L51810-01DUP | DUP-RER | 06/03/19 | | | 13 | 3.8 | 12 | 9.6 | 3.4 | 13 | | | | 0.67 | 2 | |

**Beta** M900.0 **Units:** pCi/L

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Error | LLD | Found | Error | LLD | Rec% | Lower | Upper | RPD/RER | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG473687** | | | | | | | | | | | | | | | | |
| L51810-01DUP | DUP-RER | 06/03/19 | | | 7.2 | 3 | 8.4 | 3.6 | 2.8 | 8.5 | | | | 0.88 | 2 | |
| L51810-04MSB | MS | 06/03/19 | RC190312-11 | 98.52 | 5.6 | 3 | 7.5 | 120 | 7 | 7.5 | 116 | 82 | 122 | | | |
| L51851-01DUP | DUP-RER | 06/03/19 | | | 3.2 | 2.7 | 4.2 | 2.6 | 2.7 | 4.2 | | | | 0.16 | 2 | |
| WG473104LCSWB | LCSW | 06/03/19 | RC190312-11 | 98.52 | | | | 100 | 6.3 | 2.5 | 102 | 82 | 122 | | | |
| WG473104PBW | PBW | 06/03/19 | | | | | | .44 | 1.8 | 1.9 | | | 3.8 | | | |

**Radium 226** M903.1 **Units:** pCi/L

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Error | LLD | Found | Error | LLD | Rec% | Lower | Upper | RPD/RER | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG474372** | | | | | | | | | | | | | | | | |
| WG473228PBW | PBW | 06/10/19 | | | | | | .03 | 0.06 | 0.1 | | | 0.2 | | | |
| WG473228LCSW | LCSW | 06/10/19 | PCN57865 | 20 | | | | 22 | 0.56 | 0.1 | 110 | 43 | 148 | | | |
| L51810-05DUP | DUP-RER | 06/10/19 | | | 0.19 | 0.1 | 0.12 | .02 | 0.06 | 0.16 | | | | 1.45 | 2 | |
| L52006-01DUP | DUP-RER | 06/10/19 | | | 0.33 | 0.08 | 0.26 | .26 | 0.16 | 0.38 | | | | 0.39 | 2 | N1A |
| L51810-06MS | MS | 06/10/19 | PCN57865 | 20 | 0.25 | 0.08 | 0.1 | 19 | 0.51 | 0.07 | 94 | 43 | 148 | | | |

# Radiochemistry QC Summary

**SGS Accutest**

ACZ Project ID: ***L51823***

*NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.*

**Radium 228, total** M904.0 **Units:** pCi/L

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Error | LLD | Found | Error | LLD | Rec% | Lower | Upper | RPD/RER | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG473778** | | | | | | | | | | | | | | | | |
| WG473070PBW | PBW | 06/04/19 | | | | | | -.04 | 0.31 | 0.33 | | | 0.66 | | | |
| WG473070LCSW | LCSW | 06/04/19 | PCN57186 | 9.09 | | | | 8.1 | 0.97 | 0.69 | 89 | 47 | 123 | | | |
| L51804-01DUP | DUP-RER | 06/04/19 | | | -0.54 | 0.7 | 0.76 | .13 | 0.6 | 0.63 | | | | 0.73 | 2 | |
| L51810-02MS | MS | 06/04/19 | PCN57186 | 9.09 | 0.14 | 0.7 | 0.72 | 8.5 | 0.91 | 0.61 | 92 | 47 | 123 | | | |
| L51820-05DUP | DUP-RER | 06/04/19 | | | 4.2 | 0.87 | 0.72 | 4.1 | 0.83 | 0.69 | | | | 0.08 | 2 | |
| **WG474248** | | | | | | | | | | | | | | | | |
| WG473822PBW | PBW | 06/10/19 | | | | | | .18 | 0.63 | 0.65 | | | 1.3 | | | |
| WG473822LCSW | LCSW | 06/10/19 | PCN57186 | 9.07 | | | | 7.7 | 1 | 0.76 | 85 | 47 | 123 | | | |
| L52006-02MS | MS | 06/10/19 | PCN57186 | 9.07 | 0.49 | 0.95 | 0.98 | 10 | 1.2 | 0.9 | 105 | 47 | 123 | | | |
| L51953-01DUP | DUP-RER | 06/10/19 | | | 0.82 | 0.81 | 0.81 | .61 | 0.82 | 0.83 | | | | 0.18 | 2 | |
| L51953-02DUP | DUP-RER | 06/10/19 | | | 0.05 | 0.83 | 0.87 | -.39 | 0.9 | 0.97 | | | | 0.36 | 2 | |

**Uranium 234** Eichrom ACW03 **Units:** pCi/L

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Error | LLD | Found | Error | LLD | Rec% | Lower | Upper | RPD/RER | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG473418** | | | | | | | | | | | | | | | | |
| WG472816PBW | PBW | 05/30/19 | | | | | | 1.8 | 1.2 | 0.93 | | | 1.86 | | | |
| WG472816LCSW | LCSW | 05/30/19 | RC190424-10 | 98 | | | | 89 | 6.5 | 0.78 | 91 | 77 | 122 | | | |
| L51743-02DUP | DUP-RER | 05/30/19 | | | 15 | 2.5 | 1.6 | 16 | 2.4 | 0.74 | | | | 0.29 | 2 | |
| L51851-01DUP | DUP-RPD | 05/30/19 | | | 1.8 | 0.94 | 0.71 | 9.1 | 2.2 | 2.2 | | | | 134 | 20 | |
| L51851-01DUP | DUP-RER | 05/30/19 | | | 1.8 | 0.94 | 0.71 | 9.1 | 2.2 | 2.2 | | | | 3.05 | 2 | RM |
| L51749-01MS | MS | 05/30/19 | RC190424-10 | 98 | 2 | 1.1 | 0.94 | 110 | 7.2 | 1.4 | 110 | 77 | 122 | | | |

# Radiochemistry QC Summary

**SGS Accutest**

ACZ Project ID: ***L51823***

*NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.*

**Uranium 235** Eichrom ACW03 **Units:** pCi/L

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Error | LLD | Found | Error | LLD | Rec% | Lower | Upper | RPD/RER | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG473418** | | | | | | | | | | | | | | | | |
| WG472816PBW | PBW | 05/30/19 | | | | | | 0 | 0.3 | 0.61 | | | 1.22 | | | |
| WG472816LCSW | LCSW | 05/30/19 | RC190424-10 | 4.48 | | | | 3.6 | 1.3 | 0.31 | 80 | 42 | 136 | | | |
| L51743-02DUP | DUP-RER | 05/30/19 | | | 0.31 | 0.45 | 0.66 | .56 | 0.5 | 0.49 | | | | 0.37 | 2 | |
| L51851-01DUP | DUP-RER | 05/30/19 | | | 0 | 0.38 | 1.1 | 0 | 0.82 | 1.1 | | | | 0 | 2 | |
| L51749-01MS | MS | 05/30/19 | RC190424-10 | 4.48 | -0.13 | 0.74 | 1.1 | 2.5 | 1.2 | 1.2 | 59 | 42 | 136 | | | |

**Uranium 238** Eichrom ACW03 **Units:** pCi/L

| ACZ ID | Type | Analyzed | PCN/SCN | QC | Sample | Error | LLD | Found | Error | LLD | Rec% | Lower | Upper | RPD/RER | Limit | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WG473418** | | | | | | | | | | | | | | | | |
| WG472816PBW | PBW | 05/30/19 | | | | | | .66 | 0.61 | 0.7 | | | 1.4 | | | |
| WG472816LCSW | LCSW | 05/30/19 | RC190424-10 | 97.5 | | | | 95.2 | 6.7 | 0.31 | 98 | 87 | 124 | | | |
| L51743-02DUP | DUP-RER | 05/30/19 | | | 5.31 | 1.7 | 1.2 | 7.56 | 1.6 | 0.56 | | | | 0.96 | 2 | |
| L51851-01DUP | DUP-RPD | 05/30/19 | | | 1.55 | 0.89 | 1.1 | 10 | 2.4 | 2.1 | | | | 146 | 20 | |
| L51851-01DUP | DUP-RER | 05/30/19 | | | 1.55 | 0.89 | 1.1 | 10 | 2.4 | 2.1 | | | | 3.3 | 2 | RM |
| L51749-01MS | MS | 05/30/19 | RC190424-10 | 97.5 | 0.62 | 0.91 | 1.4 | 106 | 7.2 | 0.73 | 108 | 87 | 124 | | | |

# RadChem Extended Qualifier Report

**SGS Accutest**

ACZ Project ID: ***L51823***

| ACZ ID | WORKNUM | PARAMETER | METHOD | QUAL | DESCRIPTION |
|---|---|---|---|---|---|
| **L51823-01** | WG474372 | Radium 226 | M903.1 | D1 | Sample required dilution due to matrix. |
| | | | M903.1 | N1 | See Case Narrative. |
| | | | M903.1 | N1A | See Case Narrative. |
| | WG474248 | Radium 228, total | M904.0 | D1 | Sample required dilution due to matrix. |
| | WG473418 | Uranium 234, total | Eichrom ACW03 | DF | Sample required dilution due to high sediment. |
| | | | Eichrom ACW03 | RM | For a water matrix, the duplicate precision assessment (RPD or RER) exceeded the control limit. High sediment, turbidity, or presence of an immiscible liquid attributed to non-homogeneity of the sample. |
| | | Uranium 235, total | Eichrom ACW03 | DF | Sample required dilution due to high sediment. |
| | | Uranium 238, total | Eichrom ACW03 | DF | Sample required dilution due to high sediment. |
| | | | Eichrom ACW03 | RM | For a water matrix, the duplicate precision assessment (RPD or RER) exceeded the control limit. High sediment, turbidity, or presence of an immiscible liquid attributed to non-homogeneity of the sample. |
| **L51823-02** | WG474372 | Radium 226 | M903.1 | D1 | Sample required dilution due to matrix. |
| | | | M903.1 | N1A | See Case Narrative. |
| | WG473778 | Radium 228, total | M904.0 | D1 | Sample required dilution due to matrix. |
| | WG473418 | Uranium 234, total | Eichrom ACW03 | DF | Sample required dilution due to high sediment. |
| | | | Eichrom ACW03 | RM | For a water matrix, the duplicate precision assessment (RPD or RER) exceeded the control limit. High sediment, turbidity, or presence of an immiscible liquid attributed to non-homogeneity of the sample. |
| | | Uranium 235, total | Eichrom ACW03 | DF | Sample required dilution due to high sediment. |
| | | Uranium 238, total | Eichrom ACW03 | DF | Sample required dilution due to high sediment. |
| | | | Eichrom ACW03 | RM | For a water matrix, the duplicate precision assessment (RPD or RER) exceeded the control limit. High sediment, turbidity, or presence of an immiscible liquid attributed to non-homogeneity of the sample. |
| **L51823-03** | WG474372 | Radium 226 | M903.1 | D1 | Sample required dilution due to matrix. |
| | | | M903.1 | N1A | See Case Narrative. |
| | WG473418 | Uranium 234, total | Eichrom ACW03 | DF | Sample required dilution due to high sediment. |
| | | | Eichrom ACW03 | RM | For a water matrix, the duplicate precision assessment (RPD or RER) exceeded the control limit. High sediment, turbidity, or presence of an immiscible liquid attributed to non-homogeneity of the sample. |
| | | Uranium 235, total | Eichrom ACW03 | DF | Sample required dilution due to high sediment. |
| | | Uranium 238, total | Eichrom ACW03 | DF | Sample required dilution due to high sediment. |
| | | | Eichrom ACW03 | RM | For a water matrix, the duplicate precision assessment (RPD or RER) exceeded the control limit. High sediment, turbidity, or presence of an immiscible liquid attributed to non-homogeneity of the sample. |

# Certification Qualifiers

**SGS Accutest**

ACZ Project ID: ***L51823***

Radiochemistry

| **The following parameters are not offered for certification or are not covered by AZ certificate #AZ0102.** | |
|---|---|
| Uranium 234, total | Eichrom ACW03 |
| Uranium 235, total | Eichrom ACW03 |
| Uranium 238, total | Eichrom ACW03 |

| **The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.** | |
|---|---|
| Uranium 234, total | Eichrom ACW03 |
| Uranium 235, total | Eichrom ACW03 |
| Uranium 238, total | Eichrom ACW03 |

**ACZ Laboratories, Inc.**
*2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493*

# Sample Receipt

SGS Accutest

ACZ Project ID: L51823
Date Received: 05/16/2019 11:22
Received By:
Date Printed: 5/17/2019

## Receipt Verification

| | YES | NO | NA |
|---|---|---|---|
| 1) Is a foreign soil permit included for applicable samples? | | | X |
| 2) Is the Chain of Custody form or other directive shipping papers present? | X | | ▨ |
| 3) Does this project require special handling procedures such as CLP protocol? | | X | ▨ |
| 4) Are any samples NRC licensable material? | | | X |
| 5) If samples are received past hold time, proceed with requested short hold time analyses? | X | | ▨ |
| 6) Is the Chain of Custody form complete and accurate? | X | | ▨ |
| 7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples? | | X | ▨ |

## Samples/Containers

| | YES | NO | NA |
|---|---|---|---|
| 8) Are all containers intact and with no leaks? | X | | ▨ |
| 9) Are all labels on containers and are they intact and legible? | X | | ▨ |
| 10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time? | X | | ▨ |
| 11) For preserved bottle types, was the pH checked and within limits? [1] | X | | |
| 12) Is there sufficient sample volume to perform all requested work? | X | | ▨ |
| 13) Is the custody seal intact on all containers? | | | X |
| 14) Are samples that require zero headspace acceptable? | | | X |
| 15) Are all sample containers appropriate for analytical requirements? | X | | ▨ |
| 16) Is there an Hg-1631 trip blank present? | | | X |
| 17) Is there a VOA trip blank present? | | | X |
| 18) Were all samples received within hold time? | X | | ▨ |

NA indicates Not Applicable

## Chain of Custody Related Remarks

## Client Contact Remarks

## Shipping Containers

| Cooler Id | Temp(°C) | Temp Criteria(°C) | Rad(µR/Hr) | Custody Seal Intact? |
|---|---|---|---|---|
| NA30572 | 3.5 | <=6.0 | 15 | Yes |

Was ice present in the shipment container(s)?

`Yes - Wet ice was present in the shipment container(s).`

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

# Sample Receipt

SGS Accutest

| | |
|---|---|
| ACZ Project ID: | L51823 |
| Date Received: | 05/16/2019 11:22 |
| Received By: | |
| Date Printed: | 5/17/2019 |

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

L51823

**SGS** L51823 Chain of Custod

# CHAIN OF CUSTODY

SGS North America Inc. - Wheat Ridge
4036 Youngfield Street, Wheat Ridge, CO 80033
TEL: 303-425-6021 FAX: 303-425-6854
www.sgs.com/ehsusa

**Page 1 of 1**

FED-EX Tracking #:
Bottle Order Control #:
SGS Quote #:
SGS Job #: **DA15855X**

## Client / Reporting Information

Company Name: SGS North America Inc.
Street Address: 4036 Youngfield Street
City: Wheat Ridge, State: CO, Zip: 8003:
Project Contact E-mail: terri.mcnulty@sgs.com
Phone #: 303-425-6021
Fax #:
Sampler(s) Name(s): ZW
Phone:

## Project Information

Project Name: DA15855X

**Send Report and Invoice to:**
Elizabeth.Sutcliffe@sgs.com; Carissa.Cumine@sgs.com; Janel.Mulholland@sgs.com; Elizabeth.Bolstad@sgs.com; Scott.Heideman@sgs.com; Larisa.Dimarco@sgs.com

## Requested Analysis ( see TEST CODE sheet)

| SGS Sample # | Field ID / Point of Collection | MEOH/DI Vial # | Collection | | | Matrix | # of bottles | Number of preserved Bottles | | | | | | | | Gross Alpha + Beta + Total Solids (900 Series) | Radium 226/228 (903.1) | Isotopic Uranium (ACW03) | LAB USE ONLY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Date | Time | Sampled by | | | HCl | NaOH | HNO3 | H2SO4 | NONE | DI Water | MEOH | ENCORE | | | | |
| 1X | DA15855-1X | | 5/14/19 | 1:00:00 PM | ZW | AQ | | | | | | | | | | X | X | X | |
| 3X | DA15855-3X | | 5/13/19 | 1:20:00 PM | ZW | AQ | | | | | | | | | | X | X | X | |
| 5X | DA15855-5X | | 5/13/19 | 4:30:00 PM | ZW | AQ | | | | | | | | | | X | X | X | |

**Matrix Codes**

- DW - Drinking Water
- GW - Ground Water
- WW - Water
- SW - Surface Water
- SO - Soil
- SL- Sludge
- SED-Sediment
- OI - Oil
- LIQ - Other Liquid
- AIR - Air
- SOL - Other Solid
- WP - Wipe
- FB-Field Blank
- EB-Equipment Blank
- RB- Rinse Blank
- TB-Trip Blank

**Turnaround Time ( Business days)**

Approved By (SGS PM): / Date:

☐ Standard 10 Day (business)
☐ 5 Business Days RUSH
☐ 3 Business Days RUSH
☐ 2 Business Days RUSH
☐ 1 Business Day EMERGENCY
☒ other 2/11/1900

Emergency & Rush T/A data available via Lablink Approval needed for RUSH/Emergency TAT

**Data Deliverable Information**

☐ Commercial "A" (Level 1)
☐ Commercial "B" ( Level 2)
☐ REDT1 ( Level 3)
☐ FULT1 ( Level 4)
☐ Commercial "C"
☐ State Forms
☐ EDD Format
☐ Other
☐
☒ CC

Commercial "A" = Results Only
Commercial "B" = Results + QC Summary
Commercial "C" = Results + QC Summary + Partial Raw data

**Comments / Special Instructions**

http://www.sgs.com/en/terms-and-conditions

**Sample Custody must be documented below each time samples change possession, including courier delivery.**

| | | | | | |
|---|---|---|---|---|---|
| Relinquished by Sampler: 1 | Date Time: 5/15/19 | Received By: 1 5/16/19 11:22 | Relinquished By: 2 | Date Time: | Received By: 2 |
| Relinquished by Sampler: 3 | Date Time: | Received By: 3 | Relinquished By: 4 | Date Time: | Received By: 4 |
| Relinquished by: 5 | Date Time: | Received By: 5 | Custody Seal # | ☐ Intact<br>☐ Not intact | Preserved where applicable ☐ |

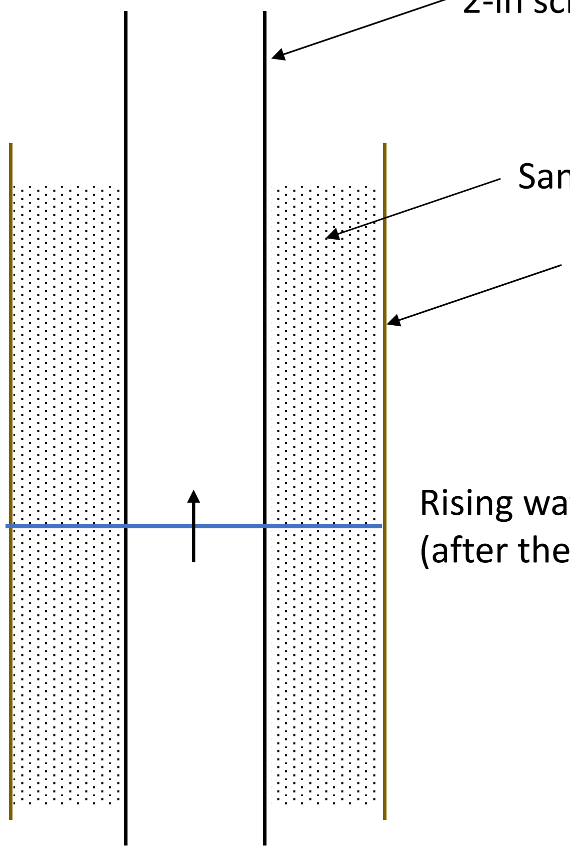
On Ice ☐ Cooler Temp. Therm. ID:

# APPENDIX C HYDRAULIC ANALYSIS

Martin Marietta Parkdale Quarry Fall Field Investigation.
December 10 - 12, 2018

| | | | |
|---|---|---|---|
| **Well 1** | Saturated thickness | 134.87 | ft |
| | T (ft^2/day) | K (ft/day) | Comment |
| Theis Recovery Analysis (Aqtesolv) | 0.289 | 0.0021 | Incomplete Recovery |
| Hvorslev Analysis 1 | 0.228 | 0.0017 | |
| Hvorslev Analysis 2 | 0.00916 | 0.000068 | Late response (seems unrealistically low) |
| | | | |
| **Well 3** | Saturated thickness | 201.45 | ft |
| | T (ft^2/day) | K (ft/day) | |
| Theis Recovery Analysis | 0.298 | 0.0015 | |
| Hvorslev Analysis | 0.781 | 0.0039 | |
| Steady-state Analysis | 0.812 | 0.0040 | |
| | | | |
| **Well 10** | Saturated thickness | 241.24 | ft |
| | T (ft^2/day) | K (ft/day) | Comment |
| Theis Recovery Analysis | | | Recovery not monitored |
| Hvorslev Analysis | | | Recovery not monitored |
| Steady-state Analysis Q1 = 0.65 gpm | 2.25 | 0.0093 | |
| Steady-state Analysis Q2 = 0.39 gpm | 1.76 | 0.0073 | |
| Steady-state Analysis Q3 = 0.012 gpm | 2.13 | 0.0088 | |
| Cooper-Jacob Analysis (Aqtesolv) | 0.830 | 0.0034 | |
| Birsoy-Summers (1980) Analysis | 0.865 | 0.0036 | |

# Well Recovery



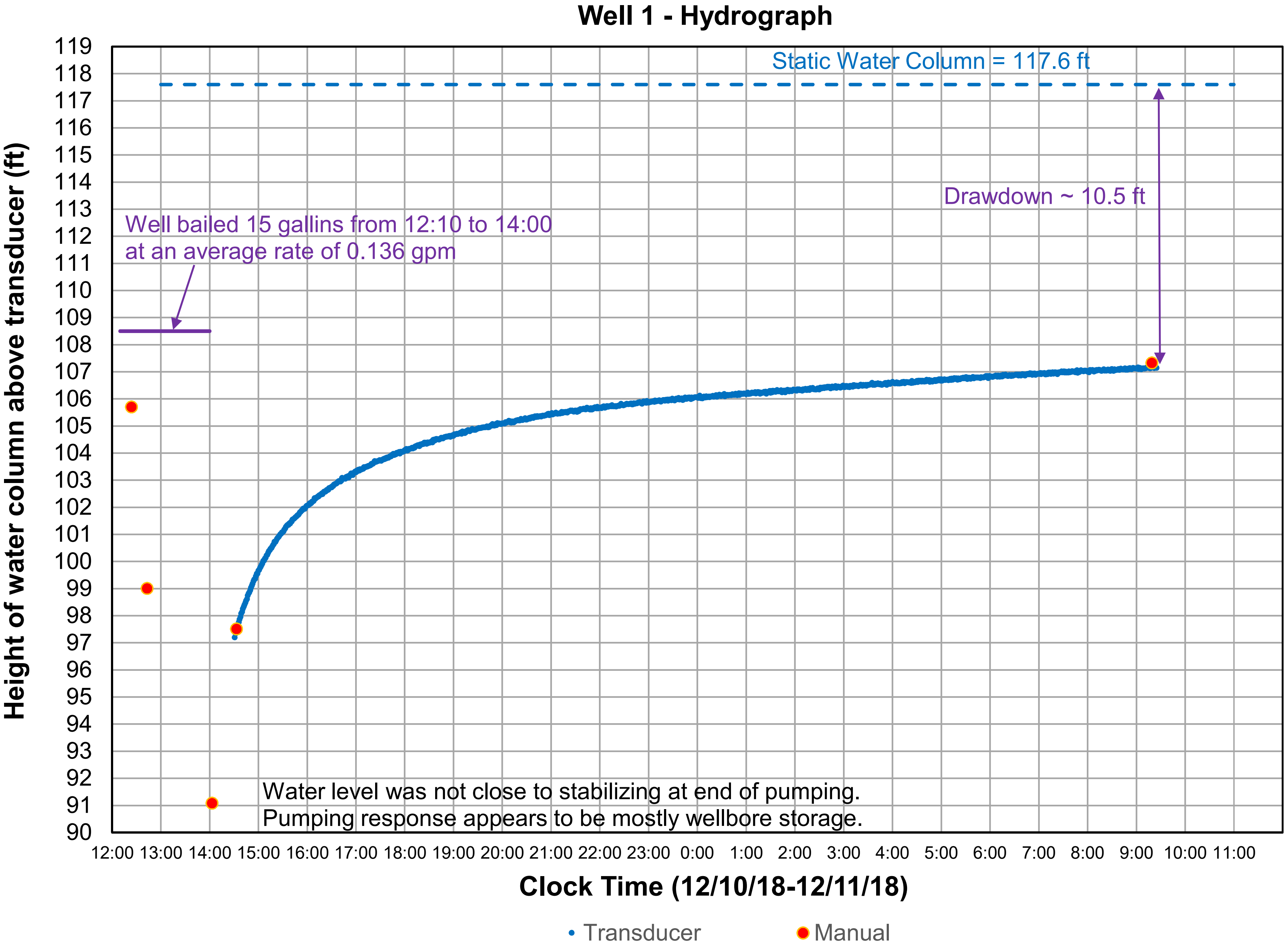
2-in sch 40 PVC

Sand pack, 30% porosity

HQ corehole, diameter = 3.77 in

Free water surface
is below seal

Rising water level during recovery
(after the pump was pulled)



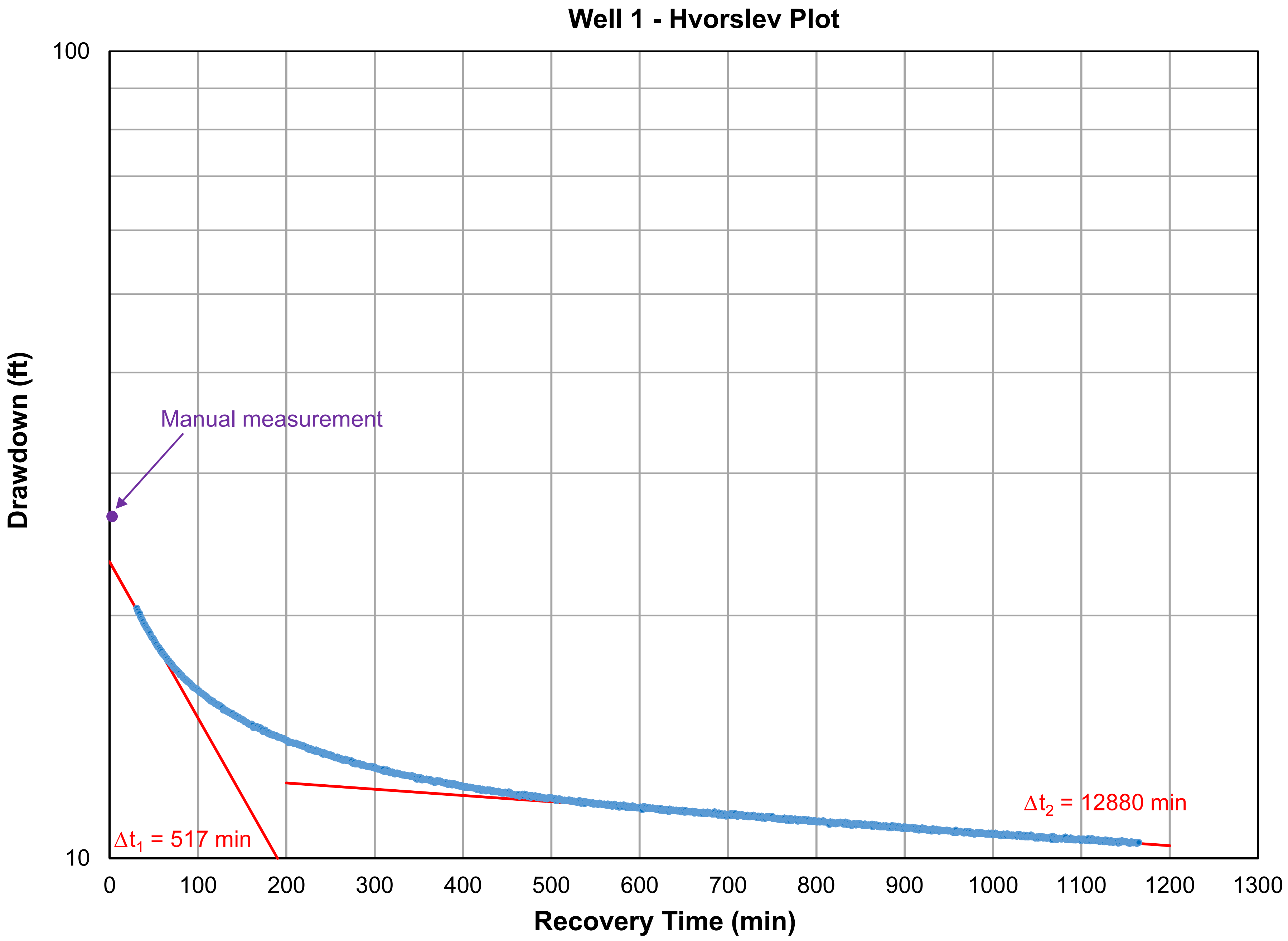
Well 1 - Hydrograph

Static Water Column = 117.6 ft

Drawdown ~ 10.5 ft

Well bailed 15 gallins from 12:10 to 14:00 at an average rate of 0.136 gpm

Water level was not close to stabilizing at end of pumping.
Pumping response appears to be mostly wellbore storage.


Well 1 - Hvorslev Plot
100
10
Drawdown (ft)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
Recovery Time (min)
Manual measurement
$\Delta t_1$ = 517 min
$\Delta t_2$ = 12880 min

## Well 1 Analyses

### Theis Recovery Analysis

Analysis not feasible. Pumping and recovery response dominated by wellbore storage. Recovery far from complete (10.5 ft of residual drawdown after 1160 minutes of recovery).

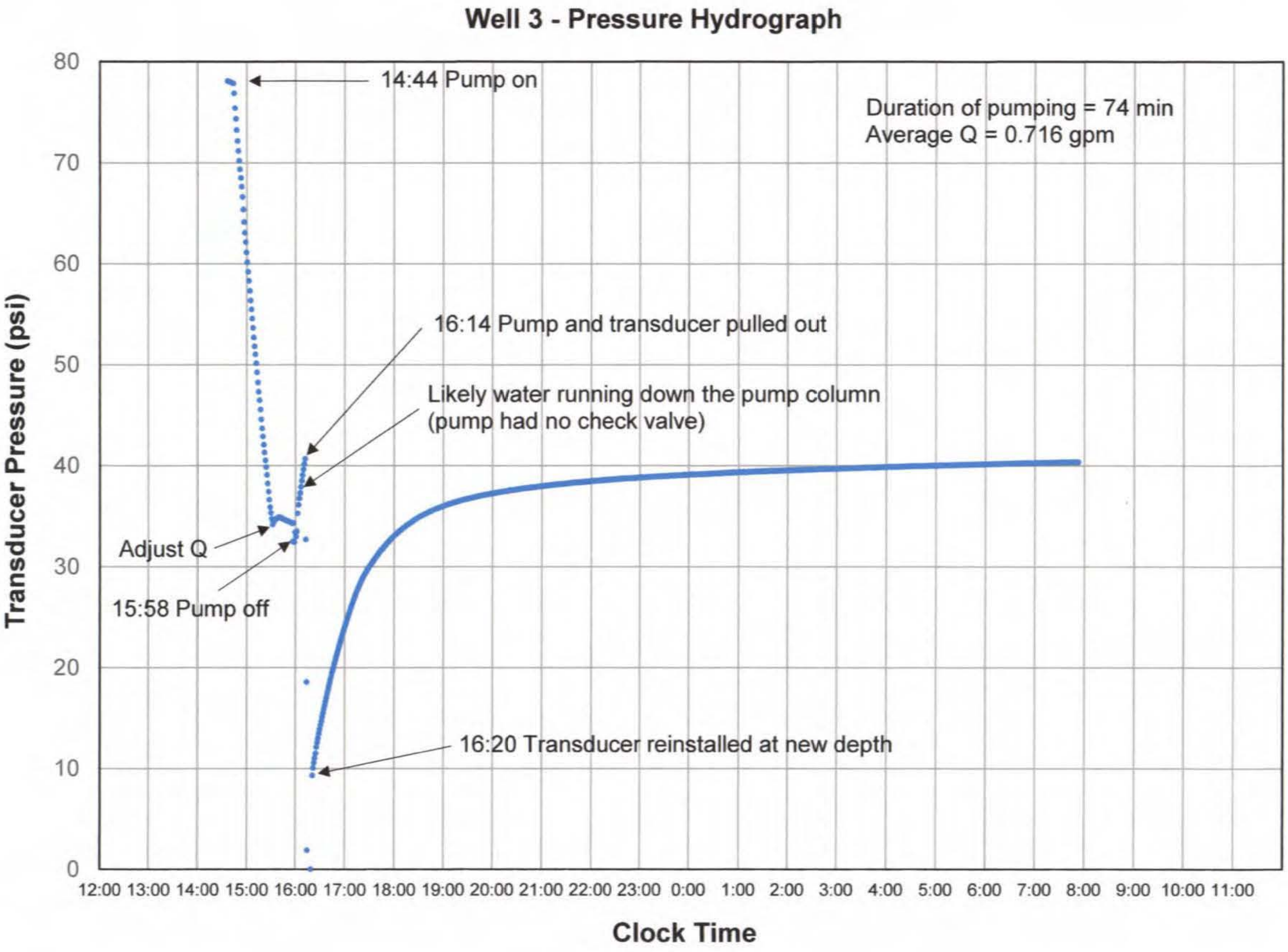
### Hvorslev Analysis 1

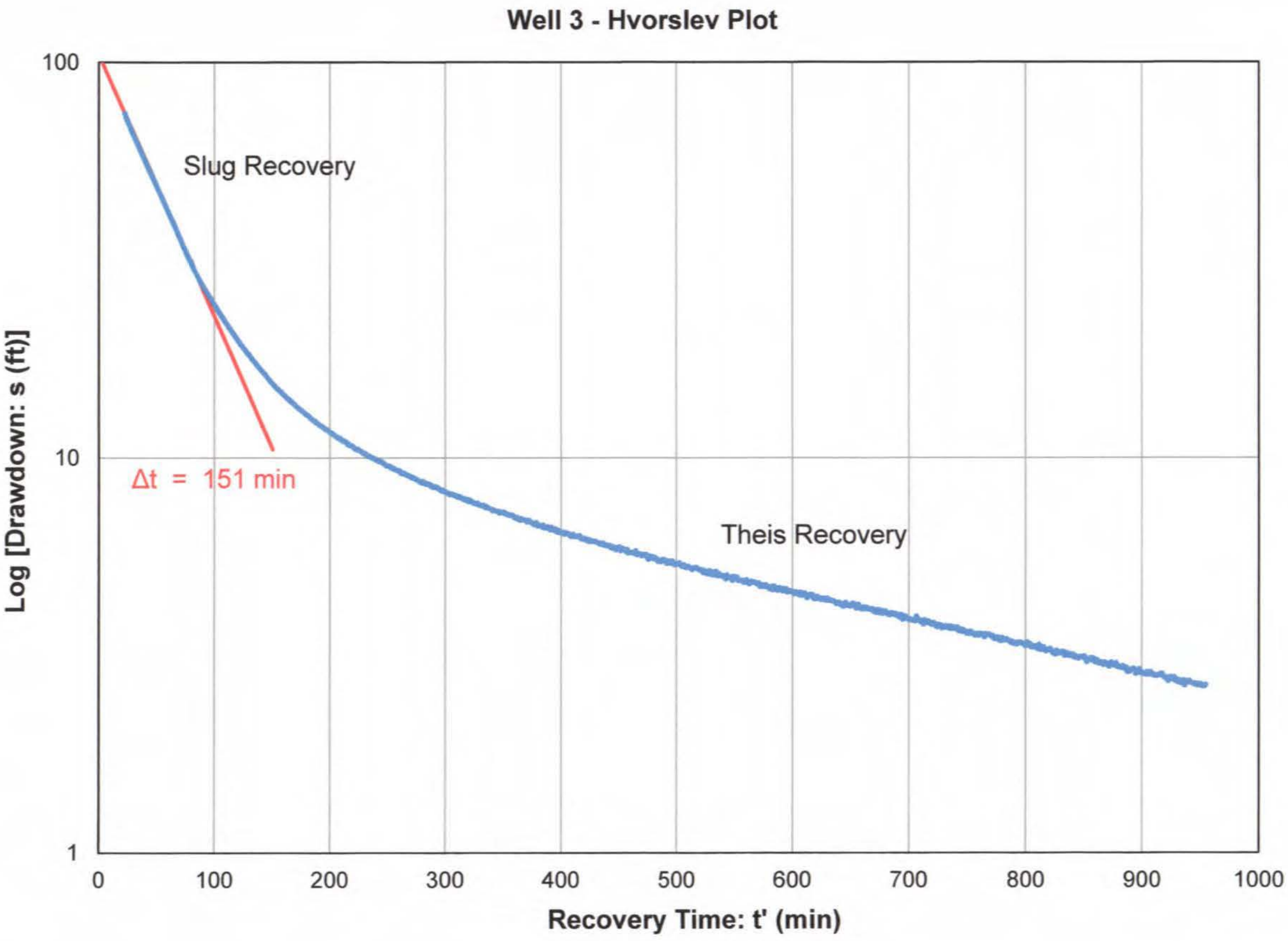
| | | |
|---|---|---|
| $d_c := 2\cdot \text{in}$ | Riser pipe diameter (2-in sch 40 PVC) | |
| $d_b := 3.77\cdot \text{in}$ | Borehole diameter (***assume HQ corehole***) | |
| $n := 0.3$ | Sand pack specific yield | |
| $A := \frac{\pi}{4}\cdot d_c^{\,2} + \frac{\pi}{4}\cdot n\cdot\left(d_b^{\,2} - d_c^{\,2}\right)$ | Casing - sand pack void area | $A = 5.548\cdot \text{in}^2$ |
| $F := 5.8$ | Hvorslev shape factor (index value) | |
| $\Delta t_1 := 517\cdot \text{min}$ | Time for one log cycle change in drawdown (early response) | |
| $T_1 := \frac{2.303\cdot A\cdot F}{2\cdot\pi\cdot\Delta t_1}$ | Computed transmissivity | $T_1 = 0.228\cdot\frac{\text{ft}^2}{\text{day}}$ |

### Hvorslev Analysis 2

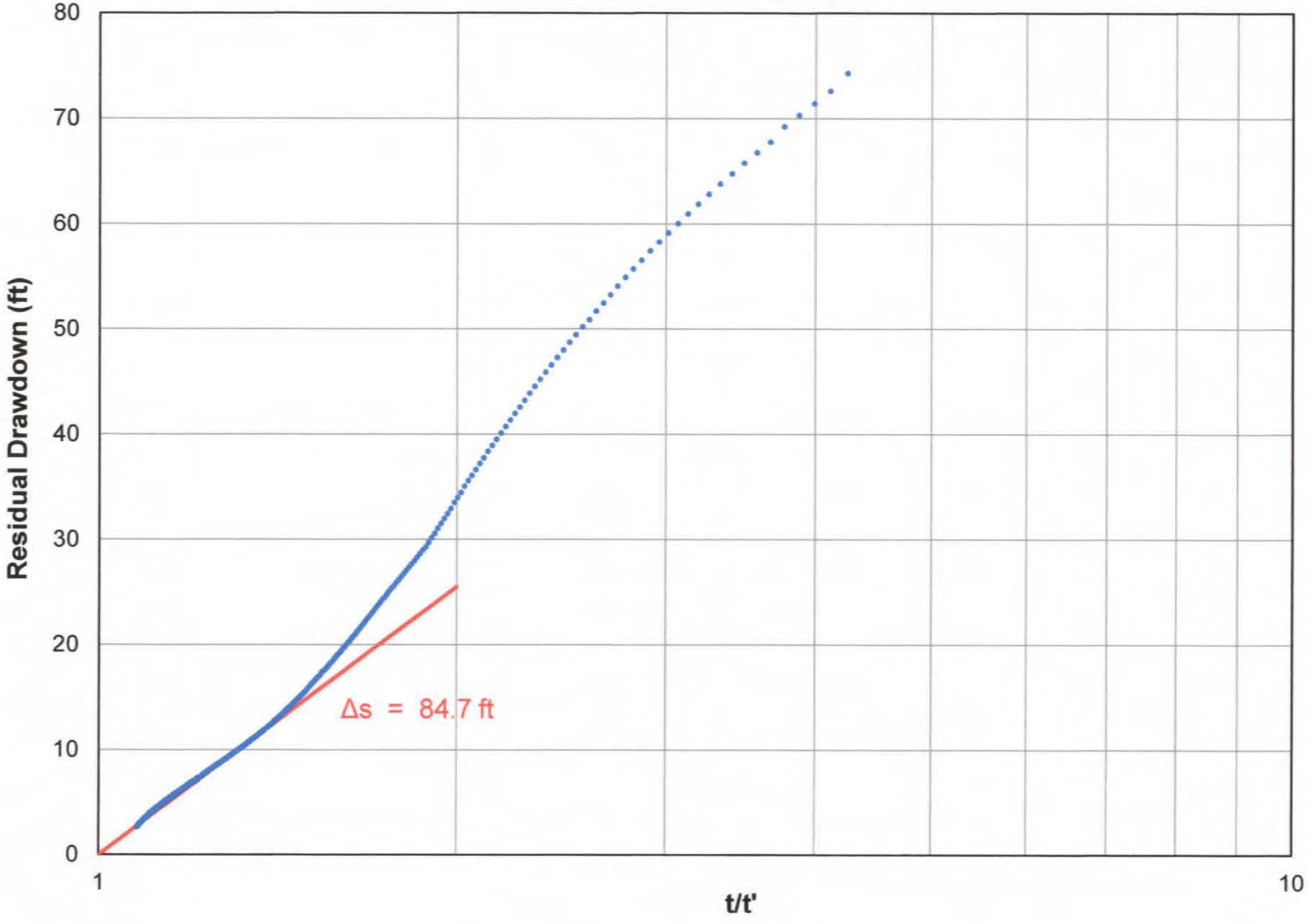
| | | |
|---|---|---|
| $\Delta t_2 := 12880\cdot \text{min}$ | Time for one log cycle change in drawdown (late response) | |
| $T_2 := \frac{2.303\cdot A\cdot F}{2\cdot\pi\cdot\Delta t_2}$ | Computed transmissivity | $T_2 = 0.00916\cdot\frac{\text{ft}^2}{\text{day}}$ |

This T seems unrealistically low


Well 3 - Pressure Hydrograph
Transducer Pressure (psi)
Clock Time
0
10
20
30
40
50
60
70
80
12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00
14:44 Pump on
Duration of pumping = 74 min
Average Q = 0.716 gpm
16:14 Pump and transducer pulled out
Likely water running down the pump column
(pump had no check valve)
Adjust Q
15:58 Pump off
16:20 Transducer reinstalled at new depth


Well 3 - Hvorslev Plot
100
10
1
Log [Drawdown: s (ft)]
Slug Recovery
Δt = 151 min
Theis Recovery
0
100
200
300
400
500
600
700
800
900
1000
Recovery Time: t' (min)

## Well 3 - Theis Recovery Plot



## Well 3 Analyses

### Theis Recovery Analysis

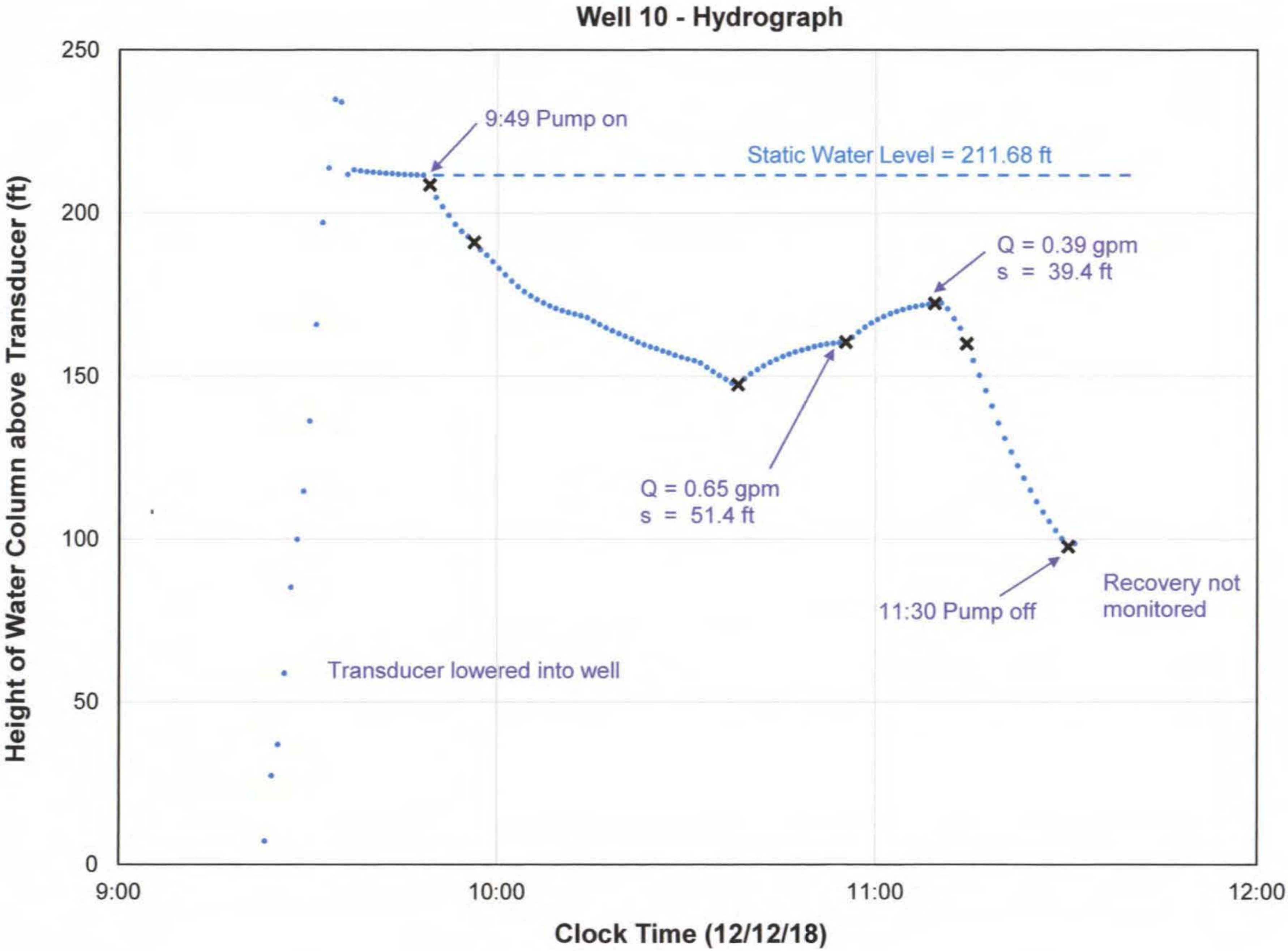
| | | |
|---|---|---|
| $Q_1 := \frac{53\text{gal}}{74\cdot\text{min}}$ | Average flow rate during pumping period | $Q_1 = 0.716\cdot\text{gpm}$ |
| $\Delta s := 84.7\cdot\text{ft}$ | Change in drawdown per log cyle on t/t' plot | |
| $T_1 := \frac{2.303\cdot Q_1}{4\cdot\pi\cdot\Delta s}$ | Computed transmissivity | $T_1 = 0.298\cdot\frac{\text{ft}^2}{\text{day}}$ |

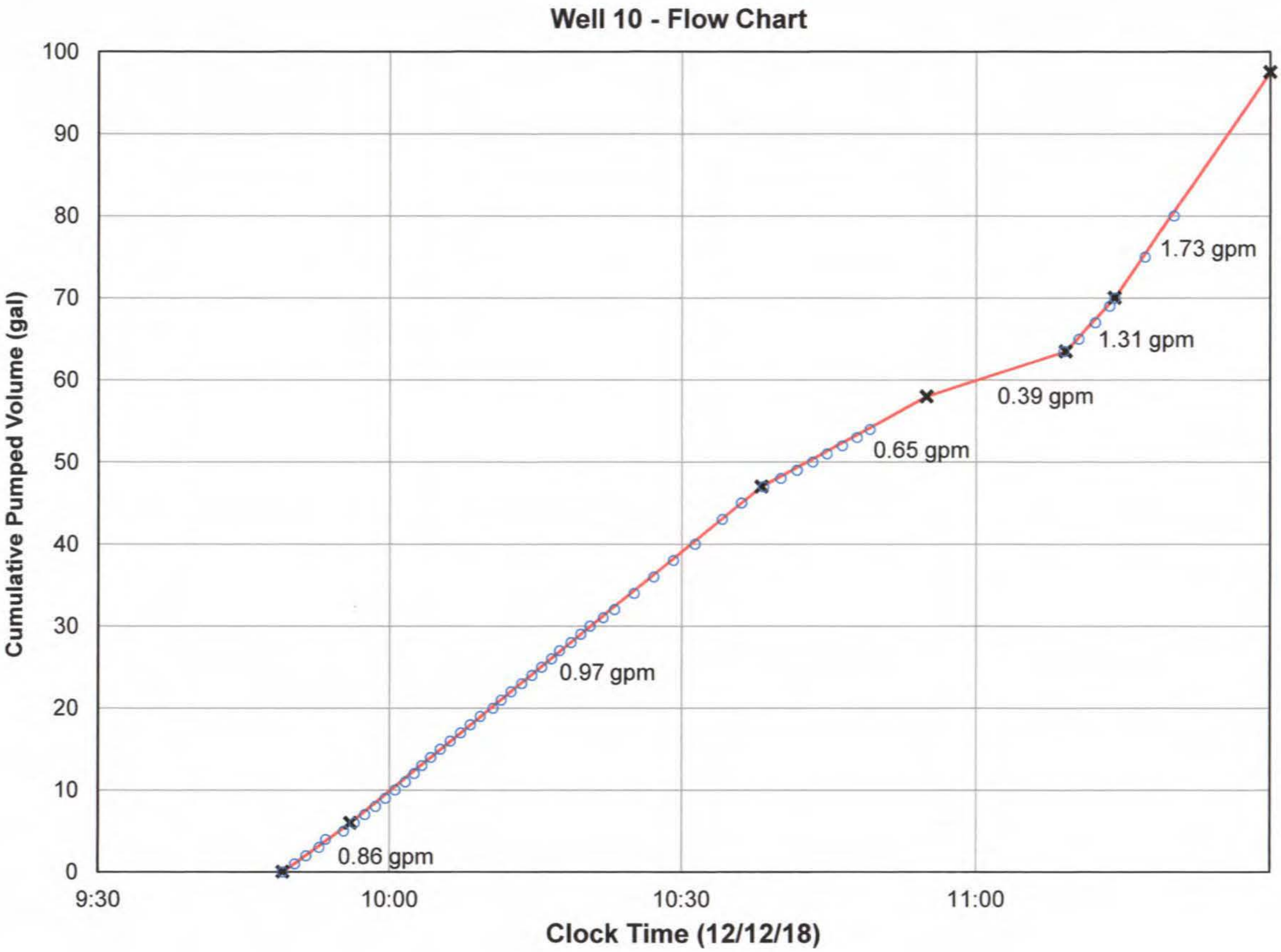
### Hvorslev Analysis

| | | |
|---|---|---|
| $d_c := 2\cdot\text{in}$ | Riser pipe diameter (2-in sch 40 PVC) | |
| $d_b := 3.77\cdot\text{in}$ | Borehole diameter (***assume HQ corehole***) | |
| $n := 0.3$ | Sand pack specific yield | |
| $A := \frac{\pi}{4}\cdot{d_c}^2 + \frac{\pi}{4}\cdot n\cdot\left({d_b}^2 - {d_c}^2\right)$ | Casing - sand pack void area | $A = 5.548\cdot\text{in}^2$ |
| $F := 5.8$ | Hvorslev shape factor (index value) | |
| $\Delta t := 151\cdot\text{min}$ | Time for one log cycle change in drawdown | |
| $T_2 := \frac{2.303\cdot A\cdot F}{2\cdot\pi\cdot\Delta t}$ | Computed transmissivity | $T_2 = 0.781\cdot\frac{\text{ft}^2}{\text{day}}$ |

### Steady-state Analysis

| | | |
|---|---|---|
| $Q_3 := 0.456\cdot\text{gpm}$ | Flow rate at end of pumping period | |
| $s := (77.98 - 34.74)\cdot 2.308\cdot\text{ft}$ | Approximately stabilized drawdown<br>at end of pumping period | $s = 99.798\cdot\text{ft}$ |
| $T_3 := \frac{Q_3\cdot F}{2\cdot\pi\cdot s}$ | Computed transmissivity | $T_3 = 0.812\cdot\frac{\text{ft}^2}{\text{day}}$ |

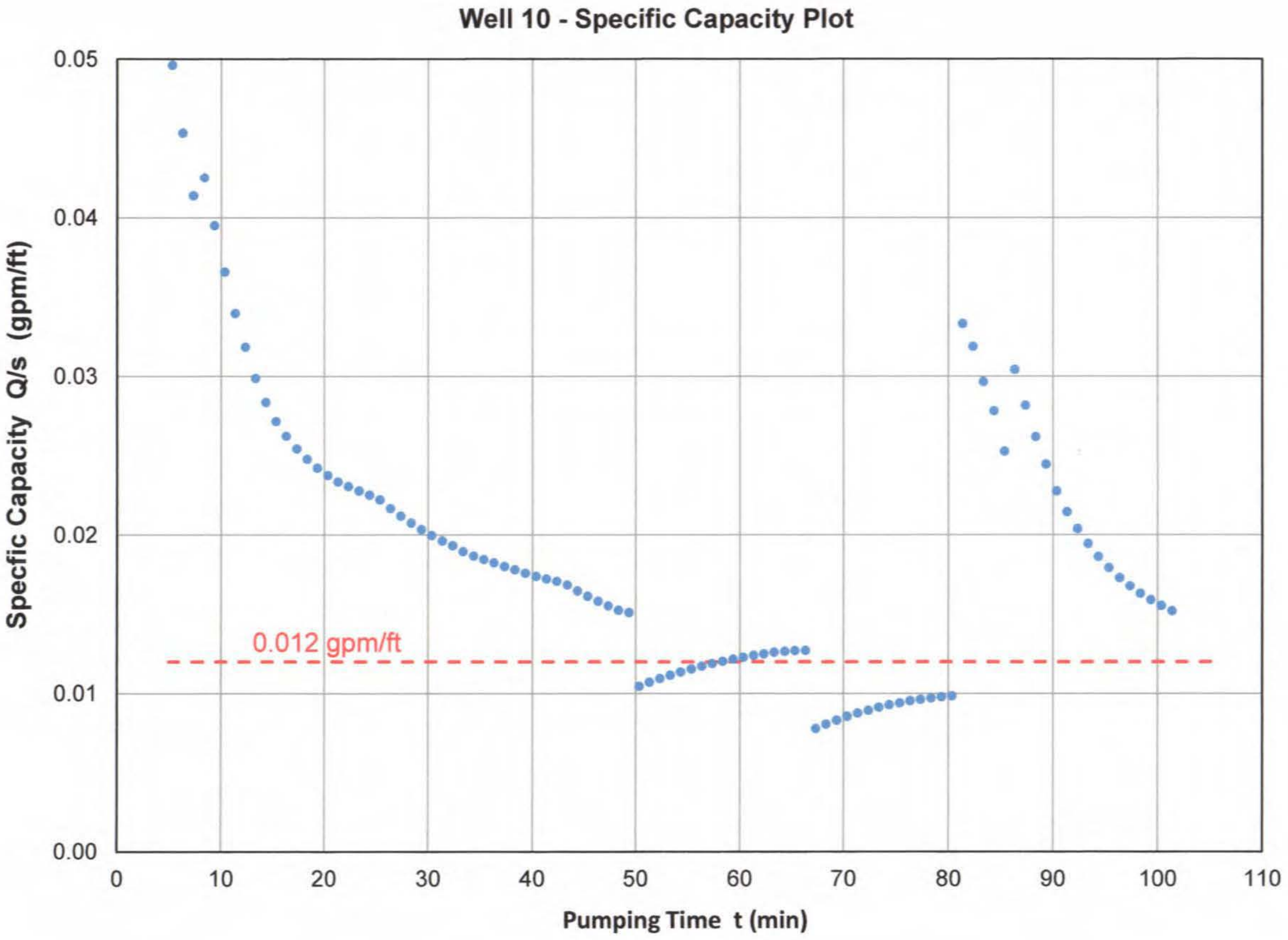

Well 10 - Hydrograph
Height of Water Column above Transducer (ft)
250
200
150
100
50
0
9:00
10:00
11:00
12:00
Clock Time (12/12/18)
9:49 Pump on
Static Water Level = 211.68 ft
Q = 0.39 gpm
s = 39.4 ft
Q = 0.65 gpm
s = 51.4 ft
11:30 Pump off
Recovery not monitored
Transducer lowered into well

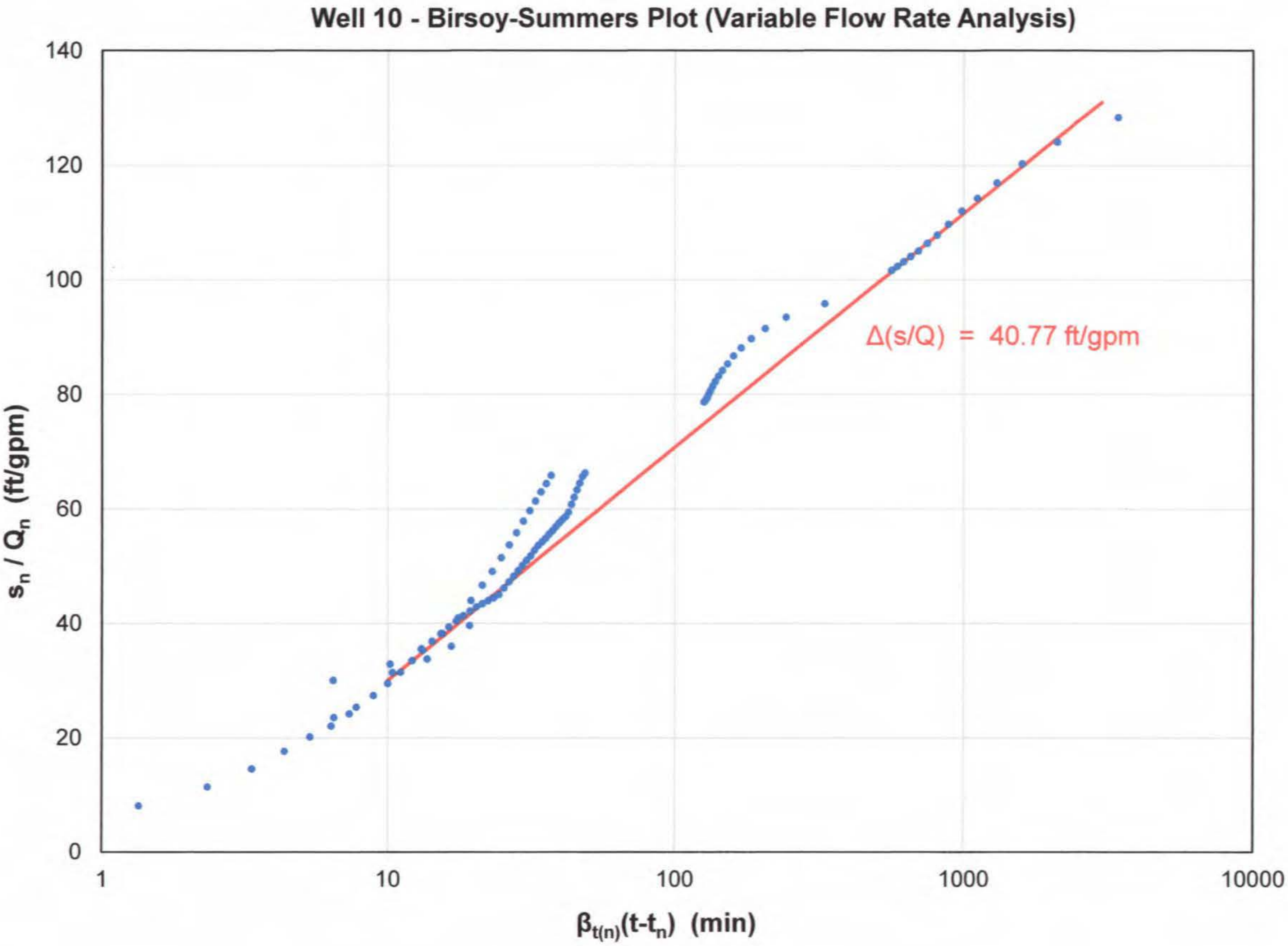


Well 10 - Flow Chart
Cumulative Pumped Volume (gal)
100
90
80
70
60
50
40
30
20
10
0
9:30
10:00
10:30
11:00
Clock Time (12/12/18)
0.86 gpm
0.97 gpm
0.65 gpm
0.39 gpm
1.31 gpm
1.73 gpm

**Flow Rate Schedule**

| Clock Time | Vol (gal) | Q (gpm) | Step | Notes |
|---|---|---|---|---|
| 9:49:00 | 0 | | | Pump on |
| 9:56:00 | 6 | 0.86 | step 1 | |
| 10:38:10 | 47 | 0.97 | step 2 | |
| 10:55:00 | 58 | 0.65 | step 3 | |
| 11:09:10 | 63.5 | 0.39 | step 4 | |
| 11:14:08 | 70 | 1.31 | step 5 | |
| 11:30:00 | 97.5 | 1.73 | step 6 | Pump off |


Well 10 - Specific Capacity Plot
Specfic Capacity Q/s (gpm/ft)
0.05
0.04
0.03
0.02
0.01
0.00
0.012 gpm/ft
0
10
20
30
40
50
60
70
80
90
100
110
Pumping Time t (min)



Well 10 - Birsoy-Summers Plot (Variable Flow Rate Analysis)
$s_n / Q_n$ (ft/gpm)
$\beta_{t(n)}(t-t_n)$ (min)
Δ(s/Q) = 40.77 ft/gpm
0
20
40
60
80
100
120
140
1
10
100
1000
10000

## Well 10 Analyses

### Cooper-Jacob Analysis

Not likely to work due to flow rate variations during the pumpng period.
Can attempt to analyse in Aqtesolve using the Birsoy-Summers (1980) variable flow rate solution.

### Theis Recovery Analysis

Recovery not monitored

### Steady-state Analysis

Approximate stabilized water level at 10:55

$Q_1 := 0.65 \cdot \text{gpm}$ Flow rate at end of pumping period

$s_1 := 211.7 \cdot \text{ft} - 160.3 \cdot \text{ft}$ Approximately stabilized drawdown at end of step 3 $s_1 = 51.4 \cdot \text{ft}$

$F := 5.8$ Shape factor (index value)

$T_1 := \dfrac{Q_1 \cdot F}{2 \cdot \pi \cdot s_1}$ Computed transmissivity $T_1 = 2.25 \cdot \dfrac{\text{ft}^2}{\text{day}}$

Approximate stabilized water level at 11:09

$Q_2 := 0.39 \cdot \text{gpm}$ Flow rate at end of pumping period

$s_2 := 211.7 \cdot \text{ft} - 172.32 \cdot \text{ft}$ Approximately stabilized drawdown at end of step 4 $s_2 = 39.4 \cdot \text{ft}$

$T_2 := \dfrac{Q_2 \cdot F}{2 \cdot \pi \cdot s_2}$ Computed transmissivity $T_2 = 1.76 \cdot \dfrac{\text{ft}^2}{\text{day}}$

Projected specific capacity on plot

$SC_3 := 0.012 \cdot \dfrac{\text{gpm}}{\text{ft}}$ Projected specific capacity on plot

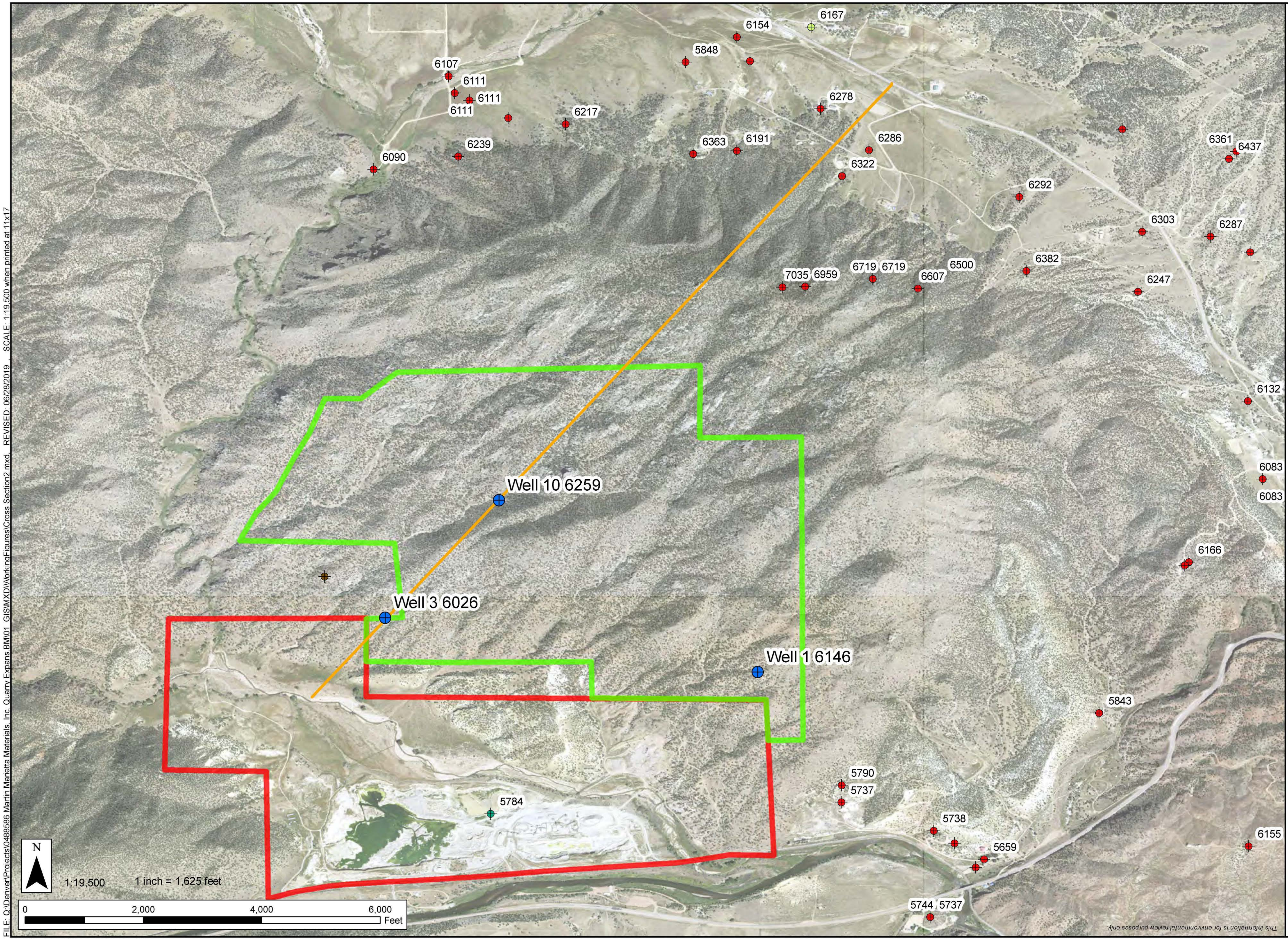
$T_3 := \dfrac{F \cdot SC_3}{2 \cdot \pi}$ Computed transmissivity $T_3 = 2.13 \cdot \dfrac{\text{ft}^2}{\text{day}}$

### Birsoy-Summers (1980) Analysis

$\Delta sQ := 40.77 \cdot \dfrac{\text{ft}}{\text{gpm}}$ Change in s/Q per log cycle

$T_4 := \dfrac{2.303}{4 \cdot \pi \cdot \Delta sQ}$ Computed transmissivity $T_4 = 0.865 \dfrac{\text{ft}^2}{\text{day}}$

# APPENDIX D SIMULATED CURRENT CONDITIONS



## Legend

🟥 MM Owned Parcel

🟩 Proposed Quarry

⊕ Monitoring Well

— Cross Section

## DWR

### Primary Use

⊕ Commercial

⊕ Domestic

⊕ Household Use

⊕ Irrigation

⊕ Monitoring

⊕ Other

⊕ Stock

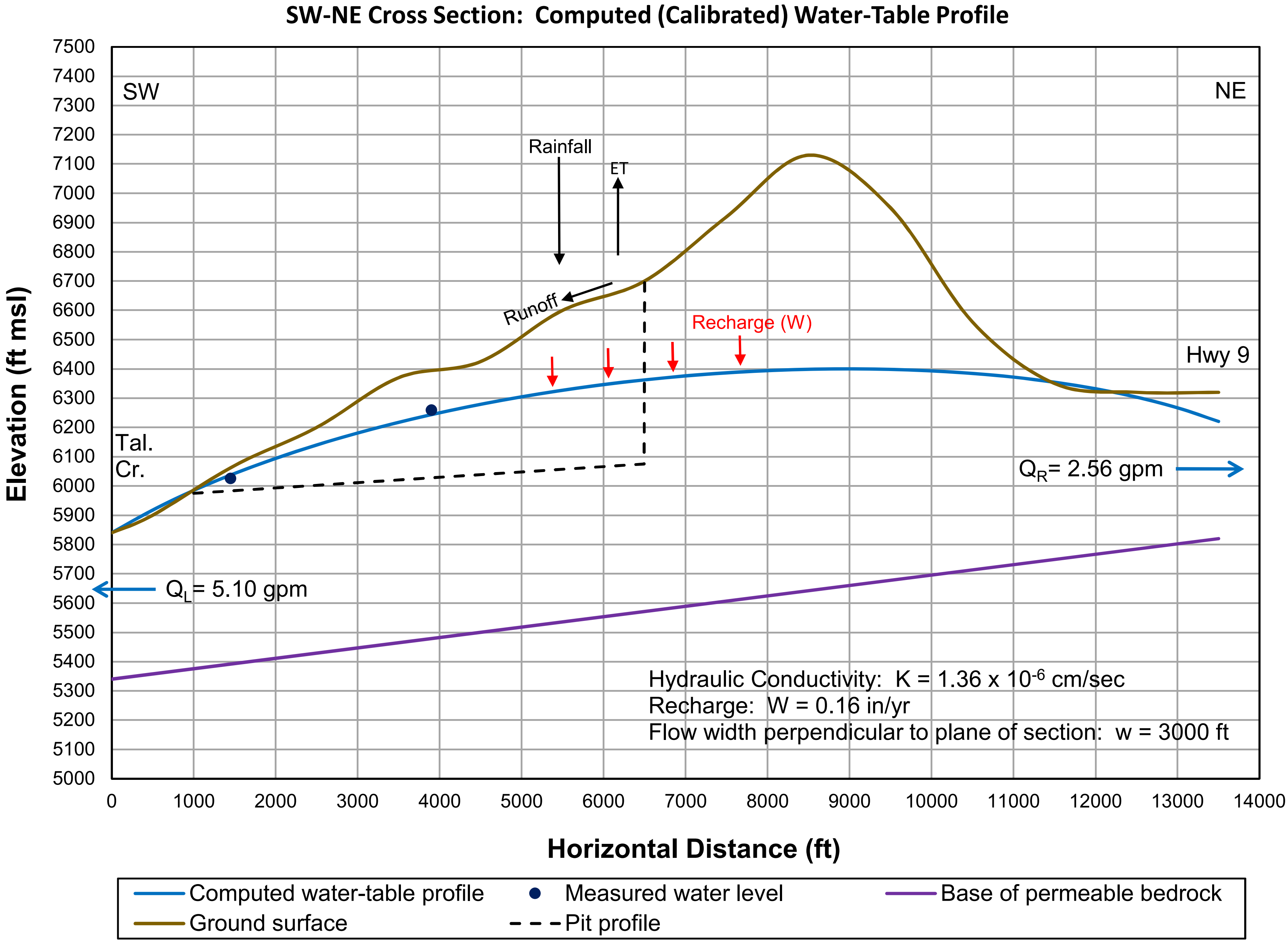
Notes:
Numbers show static water levels.
MM were measured December 2018,
DWR were measured when drilled.

**Cross Seciton**
**Static Water Levels**
Parkdale Quarry Expansion
Martin Marietta
Fremont County, Colorado

ERM West, Inc.
www.erm.com

Source: Esri - World Topographic Map

FILE: Q:\Denver\Projects\0488586 Martin Marietta Materials, Inc. Quarry Expans.BMI01 GIS\MXD\WorkingFigures\Cross Section2.mxd, REVISED: 06/28/2019 , SCALE: 1:19,500 when printed at 11x17



**SW-NE Cross Section: Computed (Calibrated) Water-Table Profile**

Hydraulic Conductivity: K = 1.36 x $10^{-6}$ cm/sec
Recharge: W = 0.16 in/yr
Flow width perpendicular to plane of section: w = 3000 ft

## Sloping Aquifer With Recharge

**Dimensionless parameters below are in units of ft-day**

### Inputs

| | | | |
|---|---|---|---|
| $KK := 1.36 \cdot 10^{-6} \cdot \frac{cm}{sec}$ | Hydraulic conductivity | $K := KK \cdot ft^{-1} \cdot day$ | $K = 0.0039$ |
| $WW := 0.16 \cdot \frac{in}{yr}$ | Recharge | $W := WW \cdot ft^{-1} \cdot day$ | $W = 3.65 \times 10^{-5}$ |
| $LL := 13500 \cdot ft$ | Length of flow system<br>(Tallahassee Ck to Hwy 9) | $L := LL \cdot ft^{-1}$ | $L = 13500.0$ |
| $ww := 3000 \cdot ft$ | Flow tube unit width | $w := ww \cdot ft^{-1}$ | $w = 3000.0$ |
| $HH_o := 5840 \cdot ft$ | Head at x = 0 (Creek elevation in msl) | $H_o := HH_o \cdot ft^{-1}$ | $H_o = 5840.0$ |
| $K(x) := K$ | Aquifer hydraulic conductivity function | | |

$G(x) := 5840 + 0.1323 \cdot x$ GS function $G(0) = 5840.0$

$G(L) = 7626.1$

$B(x) := G(0) - 500 + 0.0356 \cdot x$ Aquifer base elevation function $B(L) = 5820.6$

$$P(x) := \begin{cases} G(1000) + 0.017 \cdot (x - 1000) & \text{if } 1000 \quad x \quad 6500 \\ G(x) & \text{otherwise} \end{cases}$$

Pit bottom function

$P(2330) = 5995$

$P(6580) = 6711$

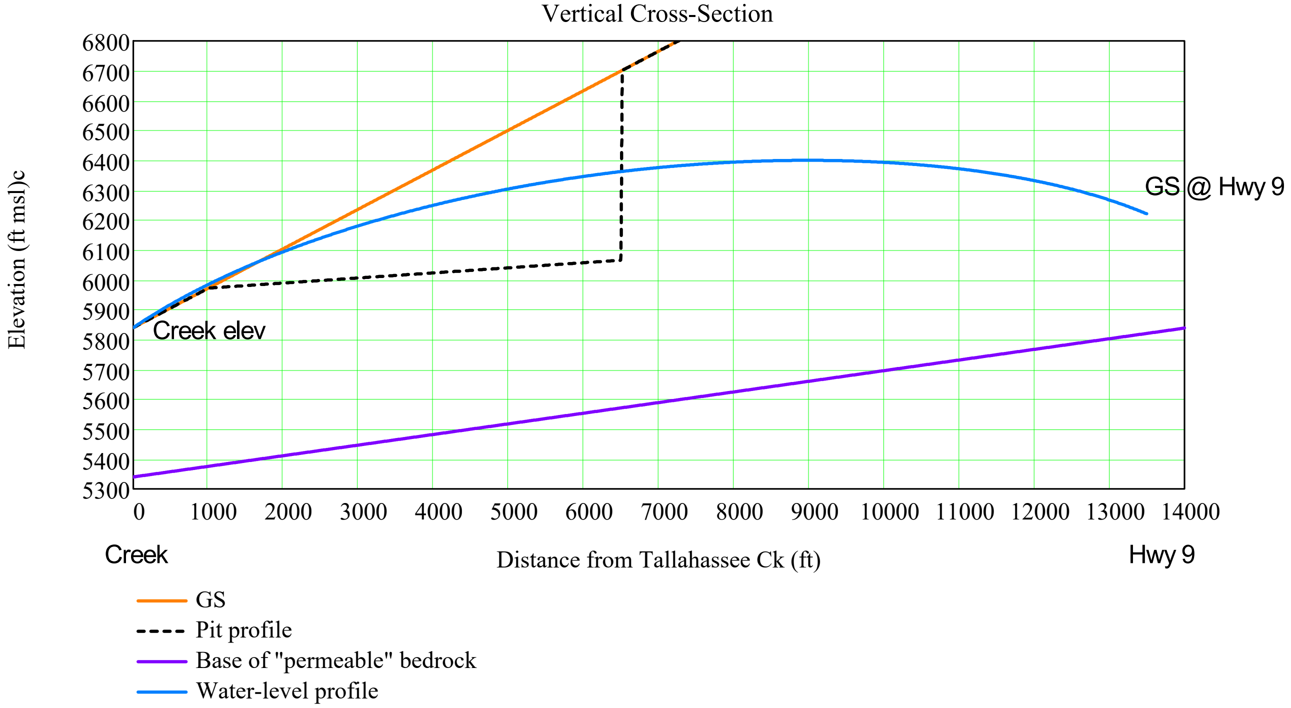
### Calcs

$QQ_o := -984 \cdot \frac{ft^3}{day}$ Iterate on this flow rate until H(L) = 6220 $QQ_o = -5.112 \cdot gpm$ $Q_o := QQ_o \cdot \frac{day}{ft^3}$ $Q_o = -984.000$

Given $\frac{d}{dx} H(x) = -\frac{\frac{Q_o}{w} + W \cdot x}{K(x) \cdot (H(x) - B(x))}$ $H(0) = H_o$ $H := \text{Odesolve}(x, L)$

Governing ODE and BC
Must be a unitless equation

$H(0) = 5840$ $H(L) = 6220$



Check flow rates with Darcy's law

$Q(x) := -K(x)\cdot w\cdot(H(x) - B(x))\cdot\frac{d}{dx}H(x)$ Darcy"s law for horizontal flow with variable saturated thickness

$Q(0.1) = -982.567$ $QQ_L := Q(0.1)\cdot\frac{ft^3}{day}$ $QQ_L = -5.104\cdot gpm$ Outlfow on left side.
This is discharge to Creek.

$Q(13499.9) = 493.376$ $QQ_R := Q(13499.9)\cdot\frac{ft^3}{day}$ $QQ_R = 2.563\cdot gpmc$ Outflow right side.
This is underflow to the northeast.

$QQ_R - QQ_L = 7.67\cdot gpmc$ Total flow leaving cross-section

$LL\cdot ww\cdot WW = 7.68\cdot gpmc$ Total recharge into cross-section

For steady-state, these should be equal

**Discussion**

This is a 1-D vertical-section groundwater hydraulic calculation. The SW-NE orientation of the section is shown on the attached map. The left (SW) side of the section is at confluence of Tallahasse Creek and Current Creek. The right (NE) side of section is at Hwy 9. Total horizontal length of the section is 13,500 ft.

Solution assumes horizontal flow according to Dupuit assumption. This is usually a good approximation if flow lines have slopes of less than 10 percent, which should be the case here.

The perennial stream at the left side of the section is assumed to be a fixed head boundary (elevation 5840 ft msl).

Solution accounts for: unform hydraulic conductivity (1.36 x 10-6 cm/sec), evenly distributed recharge (0.16 in/yr), variable saturated thickness, and sloping bottom to the bedrock "aquifer." While not invoked, the solution could consider spatially varying hydraulic conductivity [K(x)] and recharge [W(x)]. The solution could also be used for any arbitrary aquifer bottom configuation [B(x)]. The assumed hydraulic conductivity is based on pumping tests conducted at three wells within the pit area.

Mathcad solves the inhomogeneous ordinary differential equation (ODE) using the 4th order Runge-Kutta method.

For regularly fractured hard rock, a general rule of thumb is that the hydraulic condtuctivity becomes very low at about 300-500 feet below ground surface due to geostatic pressures that close fractures. This effect is approximated in the solution by placing a linear sloped no-flow boundary at 500 feet below the Creek and 500 feet below Hwy 9.

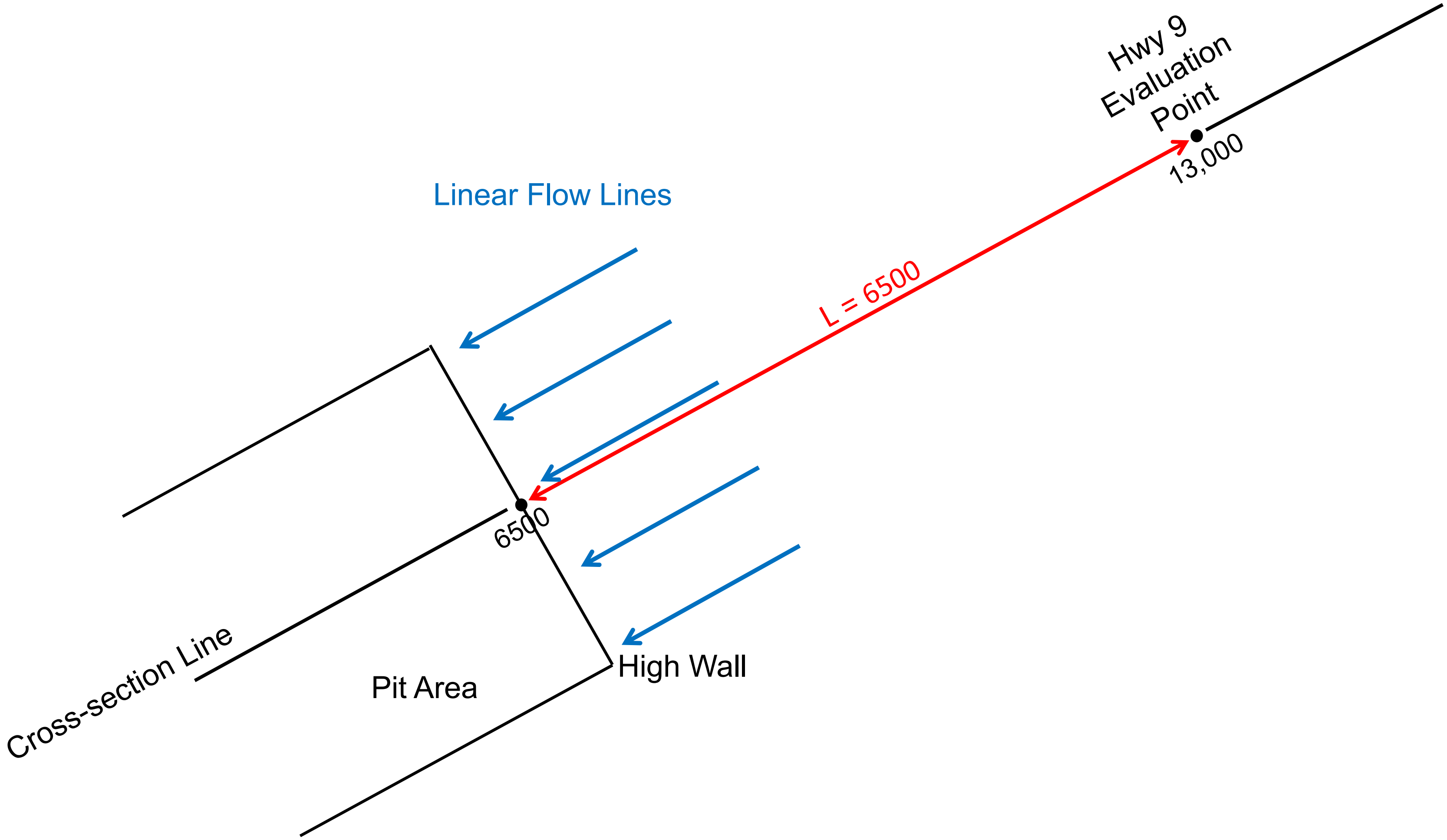
The solution is "calibrated" so that the computed water-level profile (1) conforms to water levels measured in two wells in the mine pit area and (2) is about 100 feet below ground surrface at Hwy 9.

The pit bottom profile along the vertical section [P(x)] is approximated from the pit plan provided by MM.

For these inputs, the pit bottom is predicted to extend below the water table and will therefore receive groundwater inflow. However, the flow rate is anticipated to be only several gpm. On an anual basis, more water will likely enter the pit from direct rainfall and surface runoff. Note that on the above graph, ground surface and the pit bottom are approximate.

# APPENDIX E DRAWDOWN AND PIT INFLOW ANALYSIS

# LINEAR FLOW MODEL



All distances in feet

## Linear Flow Analysis

$K := 1.36\cdot 10^{-6}\cdot\frac{cm}{sec}$ Hydraulic conductivty of granite based on pumping tests

$S_y := 0.01$ Specific yield of fractured bedrock

$b := 500\cdot ftc$ Thickness of bedrock "aquifer"

$w := 3000\cdot ftc$ Width of flow tube with linear flow

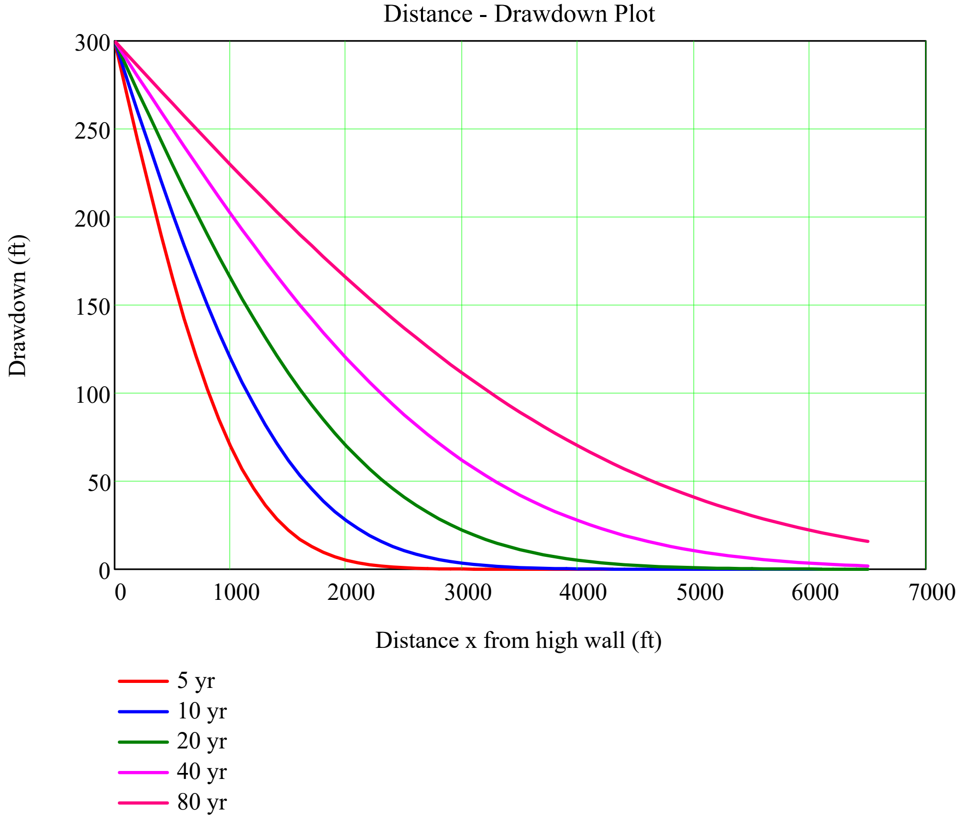
$s_p := 300\cdot ftc$ Change in head (drawdown) at pit wall (x = 0)

$\alpha := \frac{K\cdot bc}{S_y}$ Hydraulic diffusivity $\alpha = 192.756\cdot\frac{ft^2}{day}$

$s(x, t) := s_p\cdot erfc\left(\frac{x}{2\cdot\sqrt{\alpha\cdot t}}\right)$ Drawdown solution; Carslaw and Jaeger (1959; section 2.4; modified eq 3)

### Distance - Drawdown

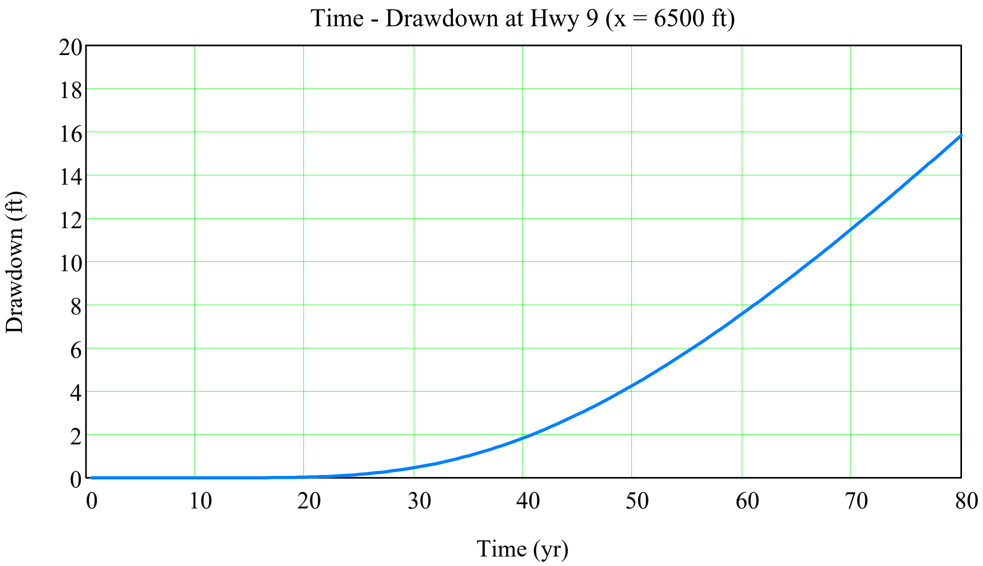
$t_1 := 5\cdot yrc$ $t_2 := 10\cdot yrc$ $t_3 := 20\cdot yrc$ $t_4 := 40\cdot yrc$ $t_5 := 80\cdot yrc$ $x := 0\cdot ftc, 100\cdot ftc .. 6500\cdot ftc$



Pit high wall is at x = 0
Hwy 9 is at x = 6500 ft (13,000 ft on SW-NE cross-section)

### Time - Drawdown at Hwy 9 (x = 6500 ft)

$t := 0.5\cdot yr, 1\cdot yr .. 80cyrc$  $x := 6500\cdot ftc$

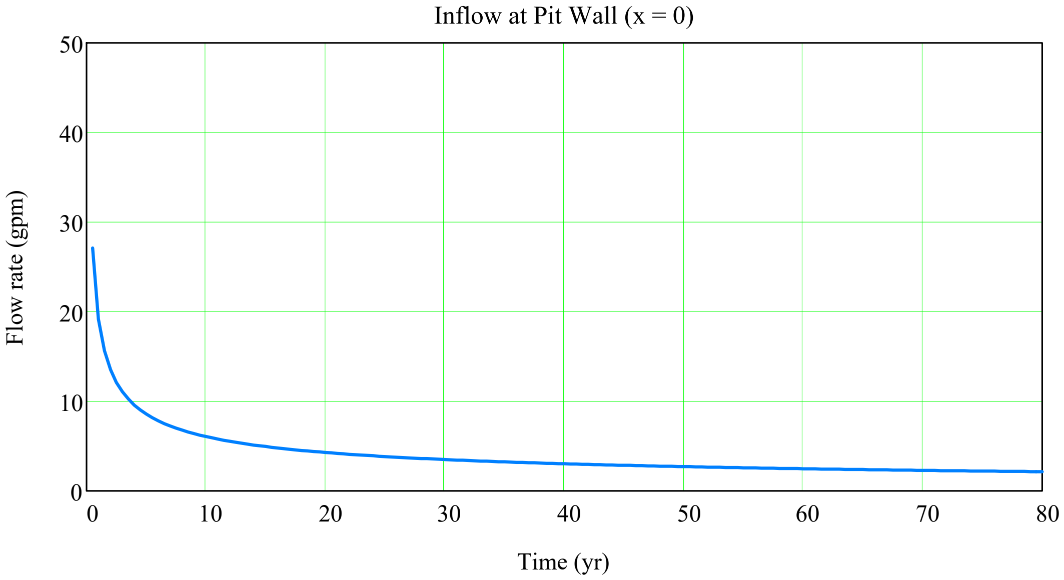


Analytical scoping level calculations conservatively tend to overestimate drawdown because it does not consider boundary conditions, recharge, or heterogeneity. It is likely that the analysis overestimates drawdown at large times.

### Flow Rate to Pit

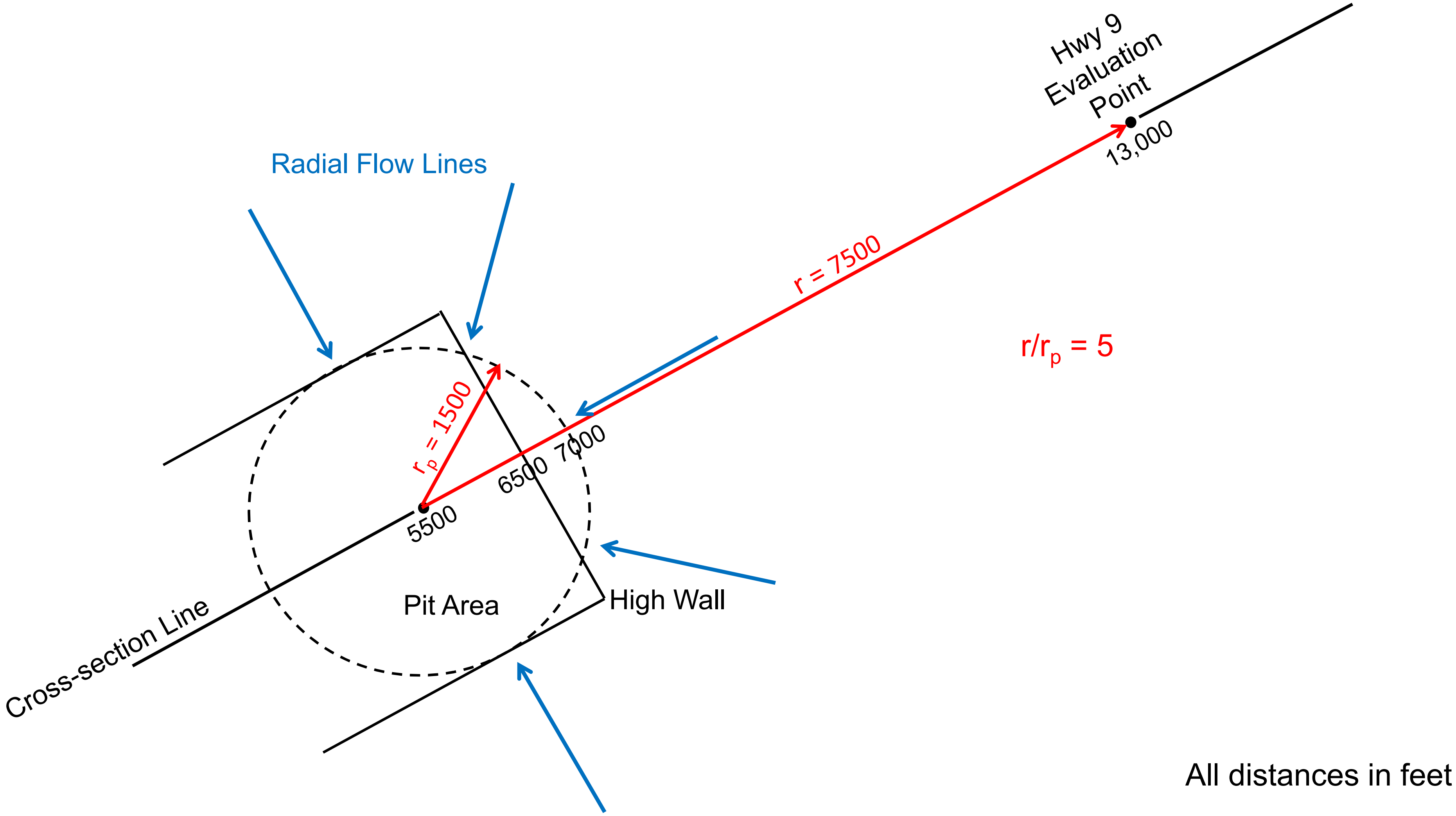
$t := 0.5\cdot yr, 1\cdot yr .. 80cyrc$  $x := 0$

$$Q(x,t) := -K\cdot b\cdot w\cdot\left(\frac{d}{dx}s(x,t)\right)$$



Results for t < 10 years not reliable because the pit will NOT be built "instantaneously." This is likely an underestimate because it does not include additional inflow along the NW and SE sides of the pit.

# RADIAL FLOW MODEL



# Radial Flow Analysis

$K := 1.36\cdot 10^{-6}\cdot\frac{cm}{sec}$ Hydraulic conductivity of granite based on pumping tests

$S_y := 0.01$ Specific yield of fractured granite

$b := 500\cdot ftc$ Thickness of granite "aquifer"

$s_p := 300\cdot ftc$ Head change (drawdown) at pit high wall

$r_p := 1500\cdot ftc$ Pit wall radius

$\alpha := \frac{K\cdot bc}{S_y}$ Hydraulic diffusivity $\alpha = 192.756\cdot\frac{ft^2}{day}$

## Laplace Transform Solution

$$L(r,p) := \frac{K0\left(r\cdot\sqrt{\frac{p}{\alpha}}\right)}{p\cdot K0\left(r_p\cdot\sqrt{\frac{p}{\alpha}}\right)}$$

From Hantush (1964), "Hydraulics of Wells"
p 331, eq 41
p 332, eq 44

## Stehfest Algorithm for Numerical Inversion of Laplace Transform Solution

$N := 14$ $i := 1,2..N$ N must be an even integer. 14, 16, and 18 are asually the best values.

$$V_i := (-1)^{\frac{N}{2}+i}\cdot\sum_{k=\mathrm{round}\left[\frac{(i+0.9)}{2}\right]}^{\min\left(i,\frac{N}{2}\right)}\left[\frac{k^{\frac{N}{2}}\cdot(2\cdot k)!}{\left(\frac{N}{2}-k\right)!\cdot k!\cdot(k-1)!\cdot(i-k)!\cdot(2\cdot kc-i)!}\right]$$

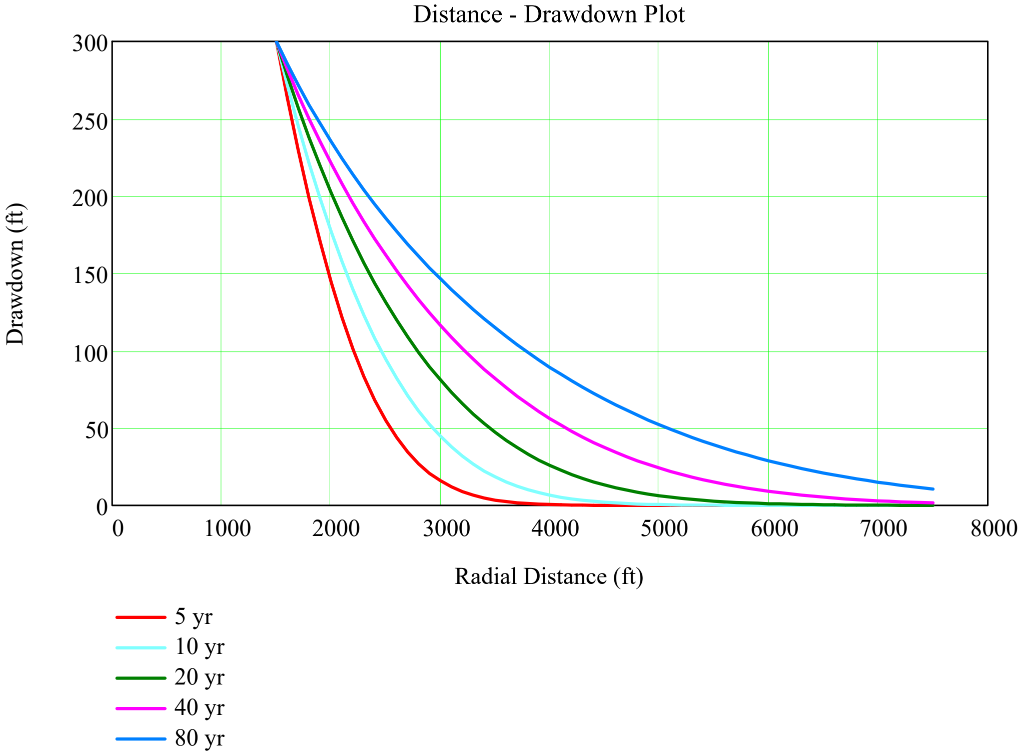
$$A(r,t) := \frac{\ln(2c)}{t}\cdot\sum_{i=1}^{N}\left(V_{ic}L\left(r,\frac{i\cdot\ln(2)}{t}\right)\right)$$

Dimensionless drawdown function
Tabulated values are in Kruseman and de Ridder (1990; Annex 1.2)

$s(r,t) := s_p\cdot A(r,t)$ Aquifer drawdown

### Distance - Drawdown

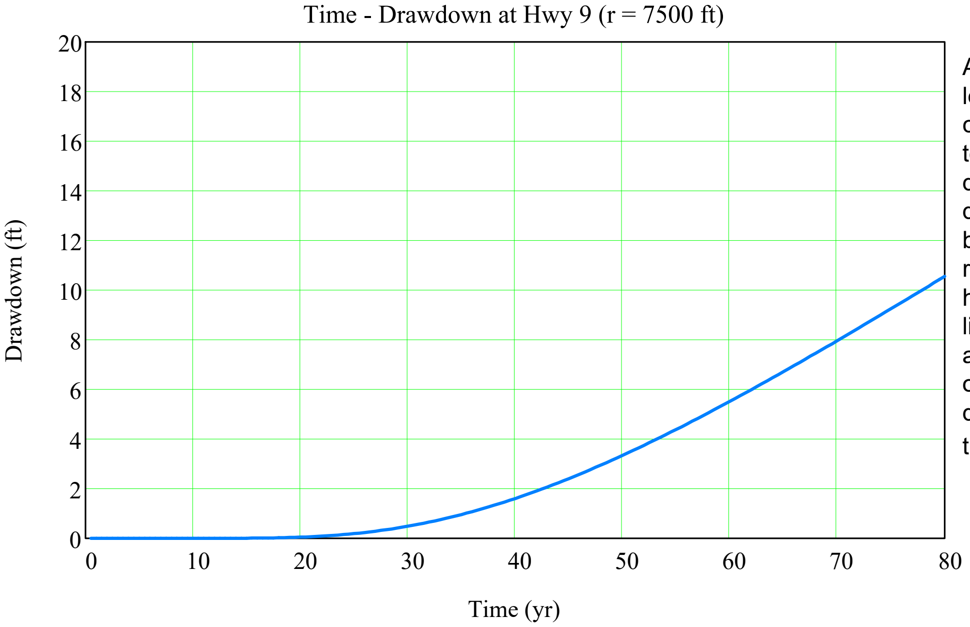
$t_1 := 5\cdot \mathrm{yrc}$ $t_2 := 10\mathrm{cyrc}$ $t_3 := 20\mathrm{cyrc}$ $t_4 := 40\mathrm{cyrc}$ $t_5 := 80\mathrm{cyrc}$ $r := 1500\cdot \mathrm{ft}, 1600\cdot \mathrm{ft} .. 7500\cdot \mathrm{ftc}$



Pit high wall is at r = 1500 ft
Hwy 9 is at r = 7500 ft (13,000 ft on SW-NE cross-section)

### Time - Drawdown at Hwy 9 (r = 7500 ft)

$t := 0.5\cdot \mathrm{yr}, 1\cdot \mathrm{yr} .. 80\mathrm{cyrc}$ $r := 7500\cdot \mathrm{ftc}$



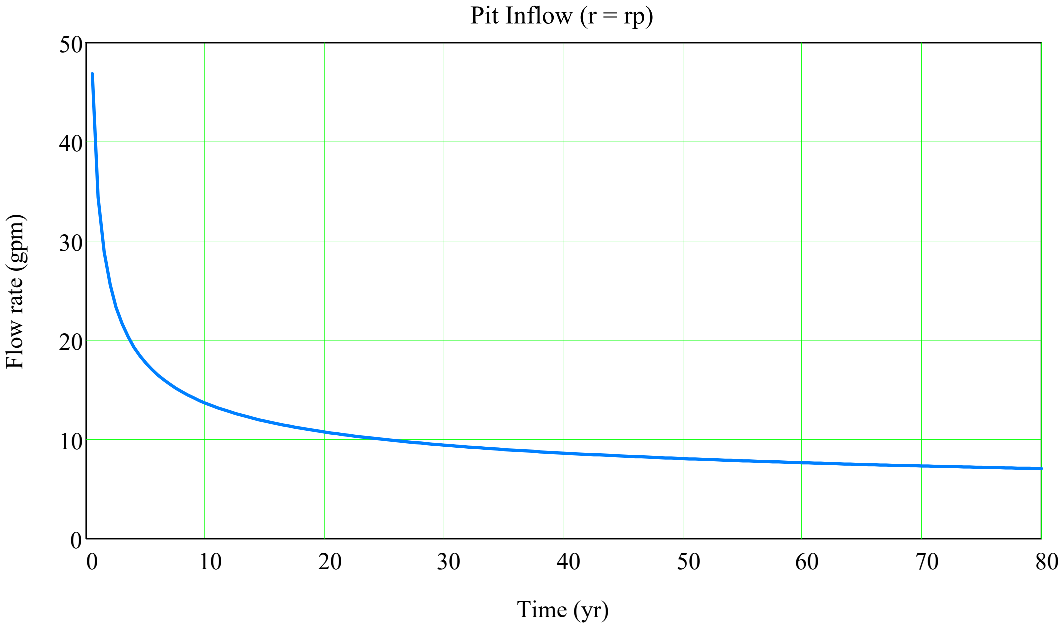
Analytical scoping level calculations conservatively tend to overestimate drawdown because it does not consider boundary conditions, recharge, or heterogeneity. It is likely that the analysis overestimates drawdown at large times.

## low Rate to Pit (assume pit receives inflow from a semi-circle)

$t := 0.5 \cdot yr, 1 \cdot yr .. 80 \cdot yr$

$\varepsilon := 0.01$

$Q_p(t) := \frac{-1}{2} K \cdot b \cdot 2 \cdot \pi \cdot r_p \cdot \frac{s\left[(1+\varepsilon) \cdot r_p, t\right] - s\left(r_p, t\right)}{\varepsilon \cdot r_p}$ Flow rate to pit using derivative approximation



Results for t < 10 years not reliable because the pit will NOT be built "instantaneously."

***Draft Environmental Impact Statement***
***Parkdale Quarry Expansion Project***

# *Appendix L*

Parkdale Quarry Stormwater Management Plan

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Martin
Marietta

# Stormwater Management Plan (SWMP)

## Parkdale Quarry
## Cañon City, Fremont County, Colorado

**Permit No. COG-500325**

**Martin Marietta Materials, Inc. – Rocky Mountain Division**
**1627 Cole Blvd, Suite 200**
**Lakewood, CO 80401**

The Stormwater Management Plan (SWMP) format is based on the Colorado Discharge Permit System (CDPS) General Permit for Sand and Gravel Mining and Processing (Permit No. COG-500000) (General Permit). This plan has been written in accordance with the updated requirements put forth by the January 1, 2017 General Permit.

The SWMP identifies potential sources of pollution (including sediment) reasonably expected to affect the quality of stormwater discharges associated with the mining activity. In addition, the SWMP describes practices to be used to reduce pollutants in stormwater discharges associated with mining activity at the facility, and ensure those practices are selected and described in accordance with good engineering practices (including the requirements for installation, implementation, and maintenance). Also, the SWMP is prepared and updated in accordance with the "Stormwater Management Plan (SWMP)" section of the "Stormwater Discharges" section of the General Permit, to ensure compliance with the terms and conditions of the General Permit.

As a condition of the General Permit, facilities must implement the provisions of the SWMP as written and updated, from commencement of facility activity until completion of final reclamation.

This SWMP includes and identifies the following:

- A facility description and map
- One or more individuals (with specification of position[s] or title[s] within the mining organization) responsible for developing, implementing, maintaining, and revising the SWMP
- Potential pollutants at the facility, and materials and business practices at the facility that may lead to discharges of polluted stormwater
- Best Management Practices (BMP) that will be used to prevent potential discharges
- Other pollution prevention measures
- A preventive maintenance program that incorporates the requirements for inspection frequency and monitoring
- Good housekeeping practices
- All discharges other than stormwater.

# Martin Marietta Materials, Inc.
# Stormwater Management Plan
# Parkdale Quarry

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APPENDIX A FIGURES
APPENDIX B REPORTING FORMS

## Figures (in Appendix A)

FIGURE 1 FACILITY LOCATION MAP
FIGURE 2 FACILITY LAYOUT MAP

# 1 PLAN CERTIFICATION

| | |
|---|---|
| Facility Name: | Parkdale Quarry (Facility #COG-500325) |
| Facility Type: | Sand & Gravel<br>(SIC: 1442 NAICS: 212321) |
| NPDES General Permit Number: | COG-500000 |
| Date that initial operation began: | 1984 |
| Facility Address: | 112 County Road 157, Cañon City, CO 81212 |
| Environmental Emergency Contact: | Beth Haake – 720-249-7447 |
| Facility Emergency Contact: | Josh Esquibel – 719-648-3490 |
| Operation Schedule: | 17 hours per day, 5 days per week. Can vary depending on season. |
| SWMP Administrator | Beth Haake – Environmental Engineer |

This stormwater management plan (SWMP) was prepared in accordance with good engineering, hydrologic, and pollution control practices. This SWMP has been prepared and implemented for the Martin Marietta Materials, Inc. (Martin Marietta) Parkdale Quarry facility located at 112 County Road 157, Cañon City, Fremont County, Colorado 81212.

In compliance with the provisions of the Colorado Water Quality Control Act (25-8-101 et seq., CRS, 1973 as amended), facilities engaged in mining and the processing of nonmetallic minerals (except fuel) are authorized to discharge surface runoff and process water from authorized locations throughout the State of Colorado to specified surface waters of the State. Such discharges shall be in accordance with conditions of the Colorado Discharge Permit System General Permit COG-500000. Martin Marietta is aware that implementation of the provisions in this SWMP is required under the condition of the permit.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowledge of violations without disclosure of these.

David Hagerman (Vice President/*General Manager*)

Signature

3-18-2019
Date

## 2 FACILITY DESCRIPTION

The Parkdale (facility) is located at 112 County Road 157, Cañon City, Colorado 81212 (see Appendix A, Figure 1). A facility map showing facility-specific characteristics and best management practices (BMP) implemented at the facility appears as Figure 2 in Appendix A, and is updated to incorporate changes at the facility.

The facility consists of approximately 570 acres of land used for the mining of granite. Site operations include excavation of granite; material loading, unloading, and conveyance; aggregate crushing and screening; vehicle and equipment maintenance and fueling; pit dewatering; and material storage and stockpiling. During the preparation of aggregate, the facility also generates wash water.

Mining activities occur at the north eastern portion of the property. These mining activities will remain in the north east portion of the facility until the reserves are depleted. Concurrent reclamation is employed at the facility and as each bench or pit is mined, it is graded to the Colorado DRMS specified slopes, then it is mulched and seeded or other final reclamation method is employed. Previous sand and gravel mining activities that occurred at the south western and south eastern portions of the property are being reclaimed to Colorado DRMS standards.

Buildings on the property consist of an office, office trailer, radio shed and an empty house all located directly north of the entrance to the property. A maintained shop is located north east of the entrance to the property. An old homestead is located along the eastern edge of the property. The homestead consist of a home and a few miscellaneous sheds. Raw material stockpiles are located at the center of the property. Once the material is mined, it is hauled from the mining face on the haul roads and deposited at the processing plant which is located south of the mining area. Once the material is processed, it is than stockpiled accordingly. From the stockpile location, the material is than loaded on to train cars that leave the property through the south eastern corner. (See Figure 1)

The mining operation is characterized by two areas of mining activity: extraction from the quarry and the processing facility. The granite quarry is located north of the Tallahassee Creek. Natural surface water resources include Tallahassee Creek and the Arkansas River lies to the southeast of the site. FEMA floodplain maps indicate portions of the operation lie within the 100-year flood plain; however, base flood elevations have not been determined. The Parkdale Quarry operation requires dewatering. Dewatering trenches and dewatering pump location changes with mining. Groundwater is collected in sedimentation ponds and used in processing. The water table fluctuates according to snow pack and seasonal precipitation. Groundwater discharge occurs only during extreme precipitation events.

The following permitted outfalls are present at the facility and are shown on Figure 2:

- **Outfall 001-A.** The discharge from a settling basin located in the south central area of the site, prior to entering the Arkansas River.

- **Outfall 002-A.** The discharge from a settling basin located in the south central area of the site, prior to entering Tallahassee Creek, tributary to the Arkansas River.

- **Outfall 003-A.** The discharge from a settling basin located in the south central area of the site, prior to entering Tallahassee Creek, tributary to the Arkansas River.

- **Outfall 004-A.** Stormwater only. Tallahassee Creek to Arkansas River
- **Outfall 005-A.** Stormwater only. Tallahassee Creek to Arkansas River

The facility map includes the following features (see Figure 2):

- Mining site and processing operation boundaries
- Surface water location and name
- Location of impervious surfaces
- Stormwater conveyances including ditches, pipes and swales
- Access and haul roads
- Stormwater outfalls and an outline of the drainage area of each stormwater outfall
- Estimated direction of stormwater flow
- Each existing structural control measure to reduce pollutants in stormwater runoff
- Non-structural BMPs, as applicable
- Springs, streams, wetlands, and other surface waters
- Mine drainage or any other process water
- Dedicated asphalt or concrete batch plants
- Areas used for recycling asphalt or concrete
- All areas current and previous mining and processing activates
- All areas of soil disturbance, reclamation and revegetation
- Locations and descriptions of all potential stormwater pollution sources, including, but not limited to, the following:
    - Materials handling areas
    - Vehicle fueling areas
    - Fertilizer or chemical storage areas
    - Areas used for storage or disposal of overburden, materials, soils, or wastes
    - Areas used for mineral milling and processing.
    - All access and haul roads
- Boundary of tributary area subject to effluent limitations
- Location of significant spills or leaks
- Stormwater monitoring points
- Non-stormwater discharge authorized by separate permit coverage
- Run onto the facility from adjacent property that contains significant quantities of pollutants
- Date the map was prepared.

## 3 DESCRIPTION OF POTENTIAL POLLUTANT SOURCES/MATERIAL INVENTORY

This SWMP identifies possible sources of pollutants (activities and materials) at the facility, and assesses the potential of these sources to contribute pollutants to stormwater discharges associated with mining activities. The SWMP also describes appropriate BMPs to reduce the potential of these identified sources contributing pollutants to stormwater discharges. These BMPs are implemented by qualified personnel employed by Martin Marietta that have completed Martin Marietta's training program.

**Loading and unloading operations.** The majority of manufacturing processes at the facility involve solid earthen materials with inert properties. These materials are not likely to significantly impair surface water or groundwater. The facility uses water to suppress dust, but not in quantities likely to cause runoff. Other loading and unloading activities include loading of aggregate into the main crushing plant hopper (partially enclosed) by haul trucks and loading crushed aggregate into costumer trucks and trains by loaders (moist material & limiting drop heights). Particulate matter is controlled while loading into the hopper and trucks by keeping the stockpiles moist and limiting the drop heights. In conclusion, loading activities are controlled by partial enclosures and water suppression.

**Outdoor storage of chemicals or equipment.** The only chemicals stored outside at the facility are petroleum products, including gasoline, diesel fuel, fuel additives, and lubricants. Heavy equipment, used and unused, is stored outside at the facility. Fuel, lubricants, coolants, battery fluids, or hydraulic fluids may be released from this equipment. These materials—in storage and in use in equipment—are covered by the facility's Spill Prevention Control and Countermeasures (SPCC) plan. Materials in storage are held in secondary containment units with a capacity of at least 110% of the container or tank capacity or are stored in double-walled steel containers on impervious surfaces. Heavy equipment (with large fuel and hydraulic oil tanks) and a refueling truck are parked in a surface depression that is expected to contain all flow on the property.

**Crushing facilities.** The facility uses crushing equipment to crush quarried materials into finer products. The crushers and screens are partially enclosed to prevent fugitive dust emissions. Dust from crushing activities is also controlled by the application of water via spray bars/nozzles. These are strategically placed throughout the primary and secondary plants to efficiently minimize dust at all applicable transfer points. The moist material is then stockpiled via conveyor.

**On-site waste disposal practices.** No waste is disposed of at the facility. Refuse generated at the facility is managed in roll off containers or dumpsters that are kept closed when not in use. The roll off containers and dumpsters are serviced by a contracted third party. There are currently no waste ponds at this facility.

**Stockpiles.** The majority of stockpiles at the facility are of solid earthen materials with inert properties. These materials are not likely to significantly impair surface water or groundwater. Areas of stockpiled materials (intermediate and finished products) are graded and bermed to direct runoff carrying suspended solids ultimately to the facility's settling ponds and permitted outfalls. In addition, runoff from other areas of the facility is channeled away from stockpiles to prevent erosion. Windblown particulates from the stockpiles are controlled by water suppression.

**Routine maintenance activities.** The facility maintains and services heavy mining equipment at the aggregate maintenance shop. Maintenance activities may generate petroleum waste, used coolants, used lubricants, and other materials that might have an impact if released. The facility SPCC plan covers accidental releases and routine cleanup procedures for this area. There is also a mobile servicing truck for the pieces of equipment that are not mobile.

**Haul roads.** Dust on haul roads is controlled by application of water from water trucks, but not in quantities sufficient to generate runoff. Roads are graded to direct runoff carrying suspended solids onto the facility property and ultimately to the facility's settling ponds and permitted outfalls.

**Disturbed areas.** Areas of active mining are disturbed. Areas of the active quarry are graded and bermed to direct runoff carrying suspended solids onto the facility property and ultimately to the facility's settling ponds and permitted outfalls. Areas of disturbance that are not active are re-vegetated to prevent erosion.

In addition, the facility discharges groundwater generated during dewatering of quarry pits. This groundwater also is directed to the settling ponds before it is discharged from one of the permitted outfalls.

**Areas exposed to air emissions.** Air emissions from processing activities are kept to a minimum by the application of water from spray bars, but not in quantities sufficient to generate runoff. Areas including but not limited to roofs that are around the processing area will be exposed to air emissions. In addition, areas downwind from the processing area will be exposed to air emissions. Stormwater runoff from these areas will be controlled so that the water carrying suspended solids into the facility is ultimately directed to settling ponds and permitted outfalls.

**Mobilization of galvanized material.** Galvanized material that may be mobilized by stormwater will be properly identified and secured within reason. The majority of galvanized material that is located at the facility is close to buildings or structure. During a stormwater event these materials should be monitored to ensure they are not mobilized.

## 4 MATERIAL INVENTORY

None of the buildings at the facility that are used to store materials have floor drains. The only materials stored outside are petroleum products and stockpiles of intermediate and finished products. The petroleum products are covered by the facility's SPCC plan and stored in secondary containment. The stockpiled materials are solid earthen materials with inert properties. Areas of stockpiled materials (intermediate and finished products) are graded and bermed to direct runoff carrying suspended solids into the facility property and ultimately to the facility's settling ponds and permitted outfalls. In addition, runoff from other areas of the facility is channeled away from stockpiles to prevent erosion. Concurrent reclamation of past mining areas will prevent potential sources of pollutants from being discharged in the pit.

## 5 STORMWATER QUALITY CONTROLS

Following is a description of stormwater quality controls and their implementation at this facility, as required by the General Permit.

### 5.1 SWMP Administrator

The SWMP Administrator is responsible for developing, implementing, maintaining, and revising the SWMP. The activities and responsibilities of the administrator shall address all aspects of the facility's SWMP. The SWMP Administrator leads the SWMP Administrative Team, identified in Section 5.2.

## 5.2 SWMP Administrative Team

| Team Members | Responsibilities |
|---|---|
| Name: Josh Esquibel<br>Title: Plant Manager<br>Phone: 719-648-3490 | • Implementing, maintaining and revising the SWMP<br>• Advise Martin Marietta Environmental Engineer of facility changes<br>• Conduct or oversee facility BMP inspections<br>• Ensure employee training |
| Name: David Hagerman<br>Title: VP/GM<br>Phone: 720-245-6400 | • Review and certify plan |
| Name: Beth Haake<br>Title: Environmental Engineer - SWMP Administrator<br>Phone: 720-249-7447 | • Develop plan and maps<br>• Update plans as informed of changes<br>• Assist in implementation, maintenance. and revisions of the SWMP at the facility<br>• Conduct employee training<br>• Develop BMPs for regional stormwater management<br>• Manage any significant release of pollutants |

## 5.3 Materials Handling and Spill Prevention

For each area or activity that poses the possibility of spills, spill prevention and response procedures have been developed. This SWMP describes and maps all practices at the facility that minimize impacts from procedures or significant materials that could contribute pollutants to runoff. The entire property is effected by these control measures that have been implemented throughout the facilities history. The specific date in which a control measure is implemented will be documented and recorded in the SWMP. In response to a spill, the employee should also refer to the SPCC Plan which is held on site along with the SWMP.

Possible areas/materials/activities that could be pollutant spill sources are:

- Loading and unloading operations
- Outdoor storage of chemicals or equipment
- Crushing facilities
- Stockpiles
- Haul roads
- Disturbed areas

The location of these features is shown on Figure 2, and a more in-depth description of the activities and materials was provided in Section 3.

## 5.4 Erosion and Sediment Controls

This SWMP describes the BMPs to be applied for reducing erosion and preventing the delivery of sediment to state waters. These include structural BMPs (such as silt fences, sediment ponds, drop structures, check dams) and nonstructural BMPs (such as mulching and re-vegetation). The entire property is effected by these control measure that have been implemented throughout the facilities history. The specific date in which a control measure is implemented will be documented and recorded in the SWMP.

- Loading and unloading operations – Controlled by water sprayers, partial enclosures, limiting aggregate drop heights, water truck
- Outdoor storage of chemicals or equipment – Controlled by secondary containment of at least 110% capacity, concrete pads, container fill alarms, training
- Crushing facilities – Controlled by water sprayers, partial enclosures, limiting aggregate drop heights
- Stockpiles – Controlled by site grading, settling ponds, berming, seeding, mulching, water sprayers, water truck
- Haul roads – Controlled by water truck, site grading, berming, chemical dust suppressants
- Disturbed areas – Controlled by grading, berming, settling ponds, vegetative strips, rip rapping, check dams, seeding, mulching, erosion control blankets, rock socks

## 5.5 Other Pollution Prevention Measures

The specific date in which a control measure is implemented will be documented and recorded in the SWMP on a separate tracking form. The list below includes improvements that have been made as a long-term solution for dust suppression as well as track out and discharge concerns.

## 5.6 Preventive Maintenance

The facility has implemented a preventive maintenance program to ensure that stormwater management devices and structures (e.g., settling basins or berms) are inspected and tested accordingly, to prevent conditions that could lead to breakdowns or failures and, in turn, unwanted discharges of pollutants to surface waters. The specific date in which a control measure is implemented will be documented and recorded in the SWMP on a separate tracking form

Daily inspections of all storage and activity areas are conducted as part of operations daily routine. Comprehensive inspections are completed as required based on activity at the facility (see Section 8 for additional details). At a minimum, Inspections include the following:

- Integrity of diesel and gasoline storage tanks and secondary containment
- Integrity of perimeter berms and truck wash out areas
- Fuel spills in diesel fueling area, and material spills in the silo area and mixer area
- Open aggregate storage bins
- Air and oil leaks on machinery and equipment
- Belts, pulleys, rollers, and gates on plant equipment

Cleaning and maintenance is performed as needed and in response to inspection results. Records of these inspections are available through the plant manager or another member of the facility SWMP Administration Team.

Back-up practices are in place should a runoff event occur while a control measure is off-line.

A list of devices inspected, inspection and cleaning frequencies, and items for special consideration are listed below:

| Management Device | Inspection Frequency | Cleaning Frequency | Potential Failures to Observe Closely |
|---|---|---|---|
| Hydrocarbon tanks | Monthly | As needed | Adequate containment |
| Hydrocarbon secondary containment | Monthly | As needed | Adequate containment |
| Catch basins | As needed | As needed | Insufficient capacity |
| Settling ponds | As needed | As needed | Insufficient capacity |
| Additive storage | Daily | As needed | Adequate containment |
| Containment devices (berms, ditches, etc.) | As needed | As needed | Adequate containment |
| General plant conditions | Daily | As needed | n/a |
| Perimeter erosion | As needed | As needed | Breach |
| Structural BMPs | Monthly | As needed | Adequate containment/breach |
| Vehicles | Weekly | As needed | Leaks |
| Material Handling Equipment | As Needed | As needed | Leaks |

## 5.7 Good Housekeeping

This SWMP identifies good housekeeping procedures that are utilized facility wide. Good housekeeping involves a clean, orderly facility, including: cleaning and maintenance schedules, trash collection and disposal, and grounds keeping. The specific date in which a control measure is implemented will be documented and recorded in the SWMP on a separate tracking form

Careful material storage practices have been implemented. Housekeeping includes prevention and/or reduction of spilled aggregate, and other particulate material and watering of internal roads and the application of chemical dust suppressants as needed to control fugitive dust.

Principal good housekeeping procedures are as follows:

- The material inventory is kept up to date, and all containers are labeled with the name and associated hazards.
- Safety data sheets (SDS) are available on site or through an online database to ensure that staff is aware of hazards and pollution potential.
- Routine cleanup operations are ongoing and scheduled to ensure that the storage areas and maintenance areas are clean and orderly.
- Good housekeeping, including cleanup procedures and disposal requirements, are incorporated into employee training.
- Solid waste receptacles are available on site and are emptied regularly.

## 5.8 Identification of Discharges Other than Stormwater

The stormwater conveyance system at the facility has been evaluated for the presence of discharges other than stormwater, such as sanitary waste, or process water of any kind. A number of discharges other than stormwater may not require a Colorado Discharge Permit System (CDPS) Industrial Wastewater Discharge permit, and are considered Allowable Non-Stormwater Discharges. The specific date in which a control measure is implemented will be documented and recorded in the SWMP on a separate tracking form

The entire property was both driven and walked by Martin Marietta staff in December 2018. The presence of stormwater and process water was evaluated and observed. Specifically, mine drainage including groundwater, natural springs and runoff water was evaluated. Both stormwater and process water have the potential to leave the property. Process Water Outfalls 001, 002, and 003 were observed along with stormwater Outfalls 004, and 005.

Water stored and applied at the facility for dust abatement is periodically utilized in the stockpile yard and on the access roads to suppress fugitive dust. Water for dust suppression is not applied in excess amounts that would result in an off-site discharge of liquids. Dust abatement is not necessary during precipitation events; therefore, no non-stormwater at the facility is intermingled with stormwater runoff. Water and other liquids utilized in other peripheral uses and in the production of aggregate are contained within the plant area. Any mechanical failure with the potential for surface release would be addressed through the facilities' spill response and emergency response protocols. This would include free liquids being contained and adsorbed, and properly disposing of absorbents

| Type of Discharge | No Discharge | Permitted Process Water | Unpermitted | Exempt | Control Measures |
|---|---|---|---|---|---|
| Transport discharge | X | | | | |
| Equipment wash water | X | | | | |
| Dust control (roads) | X | | | | |
| Irrigation return flows | | | | X | |
| Other agricultural discharge | | | | X | |
| Firefighting discharges | | | | X | |
| Foundation draining (SUMP) | | | | X | |
| Springs | | | | X | |
| Dewatering | | X | | | |
| Other | | | | | |

## 6 BMP IMPLEMENTATION AND DESIGN STANDARDS

According to the General Permit, facilities must select, install, implement, and maintain appropriate BMPs, following good engineering, hydrologic, and pollution control practices. BMPs implemented at the facility are designed to provide control of all potential pollutant sources associated with facility activity to prevent pollution or degradation of state waters.

All BMPs will meet the implementation and design standards outlined in the *Urban Storm Drainage Criteria Manual, Volume 3, Best Management Practices*, originally published by the Urban Drainage and Flood Control District of Denver, Colorado, in September 1992 and updated in November 2010.

Pollution Prevention BMPs

- Regular clean-up, collection and containment of debris in storage areas – minimize exposure of manufacturing, processing and material storage areas to rain, snow, snowmelt and runoff by either locating industrial materials and activities inside or protecting them with storm resistant covers.
- Spill control – including regular inspection and repair of equipment and systems that may leak, spill or release pollutants; as well as monitoring, replacement and repair of control measures.
- Secondary Containment – Prevent spills and leaks from contacting soil and possibly discharging
- Employee training

Treatment BMPs

- Use water truck to wet haul roads
- Water sprayers – to reduce dust and particulates during plant operations
- Settling ponds – divert, infiltrate, reuse, and contain stormwater runoff to minimize pollutants in the facility discharge
- Partial Enclosures – Prevents windblown particulates from entering water sources.
- Limiting Aggregate Drop Heights - Prevents windblown particulates from entering water sources.
- Chemical Suppressants - Prevents windblown particulates from entering water sources.
- Overfill Alarms – Prevents tanks from being overfilled during product delivery (diesel, Gasoline)

Source Reduction BMPs

- Diversion dikes and berms (site grading) –vegetated swales and natural depressions can reduce in-stream impacts of erosive flows. Dikes, curbs and berms can be used for discharge diversions.
- Erosion and sediment controls – stabilize exposed areas and contain runoff using structural and/or non-structural control measures to minimize the onsite erosion and sedimentation.
- Vegetative covers – minimize impervious areas and infiltrate runoff on-site into the retention pond can reduce runoff and improve groundwater recharge and streams base flows in local streams
- Conserving and/or repairing riparian buffers will help protect streams from stormwater runoff and improve water quality
- Prevent or minimize discharge of spilled, aggregate and settled dust into stormwater.
- Seeding – Increase vegetative cover of inactive or reclaimed areas.
- Mulching – Aids in preventing seeds from blowing away and provides additional moisture allow seeds to root.
- Rip Rap – Dissipates water flow velocity allowing sediment to fall from water prior to discharge
- Check Dams - Dissipates water flow velocity allowing sediment to fall from water prior to discharge

- Rock Socks - Dissipates water flow velocity allowing sediment to fall from water prior discharge. Also prevents erosion.
- Erosion Control Blankets – Protects un-vegetated slopes from direct precipitation and runoff thus protecting from erosion.

## 7 CONSISTENCY WITH OTHER PLANS

The provisions of this SWMP are consistent with the requirements of the facility's SPCC plan and with all provisions of the facility-specific certifications under the revised General Permit (COG-500325).

## 8 FACILITY INSPECTIONS

In addition to the inspections necessary to comply with the preventive maintenance program requirements described in Section 5.6, qualified personnel conduct comprehensive inspections of the stormwater management system.

Comprehensive inspections performed by qualified individuals, record keeping and internal reporting are essential activities under the SWMP and are outlined below. All records and reports are maintained with the plan at the facility's management office.

Qualified personnel shall make a comprehensive inspection of the stormwater management system at least quarterly. These comprehensive inspections must be documented and summarized in the Annual Report.

Material handling areas, disturbed areas, areas used for material storage that are exposed to precipitation, and other potential sources of pollution identified in the SWMP in accordance with the permit shall be inspected for evidence of, or the potential for, pollutants entering the drainage system. Structural stormwater management measures, sediment and control measures, and other structural pollution prevention measures identified in the plan shall be observed to ensure that they are operating correctly. A visual inspection of equipment needed to implement the plan, such as spill response equipment, shall be made.

Any repairs or maintenance needs identified by the inspection shall be completed immediately. Based on the results of the inspection, the description of potential pollutant sources and pollution prevention measures identified in the SWMP shall be revised as appropriate. The SWMP shall be revised as appropriate as soon as practicable after the inspection. Such revisions to the SWMP shall provide for implementation of any changes to the SWMP in a timely manner.

A report summarizing the scope of the inspection, personnel completing the inspection, the date(s) of the inspection, major observations relating to the implementation of the SWMP, and actions taken as described above shall be made and retained as part of the SWMP for at least 3 years. The report shall be signed by a SWMP Administrator.

Sampling Schedule for Inspection:

Sampling is completed quarterly for all stormwater outlets and bimonthly for all process water outfalls.

# 9 SWMP AVAILABILITY

Upon request, and within time frames specified in the request, the facility will submit a copy of the SWMP to the Water Quality Control Division (Division) of the Colorado Department of Public Health and Environment (CDPHE); the Colorado Division of Reclamation, Mining, and Safety (CDRMS) (formerly the Division of Minerals and Geology [DMG]); and/or the U.S. Environmental Protection Agency (EPA); and to any local agency approving sediment and erosion plans or stormwater management plans. If submittal of the SWMP is required to any of these entities, the facility will include a signed certification in accordance with "signatory and Certification Requirements" listed in the General Permit, certifying that the SWMP is complete and meets all permit requirements.

The SWMP is also considered public report that shall be available to the public under Section 308(b) of the CWA. The facility will make this SWMP available to members of the public upon request. The facility reserves the right to claim any portion of a SWMP as confidential in accordance with 40 *Code of Federal Regulations* (CFR) Part 2.

# 10 SWMP ADMINISTRATIVE REQUIREMENTS

## 10.1 SWMP PREPARATION AND IMPLEMENTATION

A certified version of this SWMP was submitted when the facility applied for coverage under the General Permit. It will be updated as appropriate (see Section 10.3).

## 10.2 SWMP RETENTION

The SWMP is maintained by the facility and located at the Parkdale Quarry management office. A copy of the SWMP will also be maintained at the regional Denver West office.

## 10.3 SWMP REVIEW/CHANGES

### 10.3.1 Division Review

The facility will provide the SWMP to the Division upon request. If notified by the Division that the SWMP does not meet one or more of the minimum requirements of the General Permit, the facility will make changes to the SWMP to include the requested changes and submit the revised SWMP to the Division within 30 days.

### 10.3.2 Permittee Review/Change

The facility will amend the SWMP whenever a change occurs in design, construction, operation, or maintenance that significantly affects potential for discharge of pollutants to the waters of the State, or if the SWMP proves ineffective in achieving the general objectives of controlling pollutants in stormwater discharges associated with mining or quarrying activity. If existing BMPs need to be modified or if additional BMPs are necessary, the SWMP changes and implementation will be completed before the next anticipated storm in a timely manner.

- The change in design, construction, operation, or maintenance
- When the SWMP has been determined ineffective.

Amendments to the plan will be summarized in the Annual Report.

The facility will also notify the Colorado Division of Minerals and Geology (formerly the Mined Land Reclamation Division) of any significant changes at the facility resulting from implementation of the SWMP.

## 11 TRAINING AND EMPLOYEE EDUCATION

Training of personnel is conducted annually to educate employees, at all levels, about the components and objectives of the facility stormwater management plan. Contractors and temporary personnel are informed of site specific design features and operations annually when renewing site specific training at the facility. Training for the SWMP will typically be concurrently held with spill response training and SPCC Plan training.

The training scope will include the following topics:

| Employee Training Task | Frequency of Training |
|---|---|
| Spill Prevention | Once per year |
| Spill Response | Once per year |
| Good Housekeeping Techniques | Once per year |
| Materials Management | Once per year |
| Sediment & Erosion Prevention | Once per year |
| Definition of Process Water | Once per year |
| Best Management Practices in Place and Proper Maintenance | Once per year formal, ongoing |

While operations are active on site, it will be the responsibility of the on-site manager or operator to train appropriate on-site personnel to achieve required SWMP goals.

Various other types of environmental trainings are conducted for the on-site management team. Environmental Training topics are used for "tailgate" meetings to discuss site-specific environmental management. On-site managers participate in a number of internal and industry meetings where environmental pollution control, regulations, and responsibilities are discussed.

Records of personnel training conducted, including attendance, date of training, and scope of training are available at the facility management office.

## 12 TOTAL MAXIMUM DAILY LOAD

Segment 03 of the Upper Arkansas River Sub-basin, Arkansas River Basin is on the 303(d) list as impaired for Zinc and Cadmium with a designation of a High priority. A TMDL has not yet been developed or finalized, and therefore waste load allocations have not been made for this parameter. At such time as a TMDL is complete, this certification may be reopened, and limitations may be added. Until such time, additional monitoring and reporting at Outfall 001A for Zinc and Cadmium will be required.

## 13 STORMWATER MONITORING

The facility will collect samples from permitted outfalls as described in Section 13.1, monitor flow rates as described in Section 13.2, and submit an annual report as described in Section 13.3.

## 13.1 ROUTINE REPORTING OF DATA

Reporting of data obtained in compliance with the "Effluent Limitations and Monitoring Requirements" of the General Permit shall be on a quarterly basis. Reporting of all data obtained shall comply with the "General Monitoring, Sampling, and Reporting Requirements" of the General Permit.

Monitoring results shall be summarized for each calendar quarter and reported on the Division-approved discharge monitoring report (DMR) forms (EPA form 3320-1). The form will be submitted to the Division's Net-DMR online service no later than the 28th day of the month following the end of the quarter. If no discharge occurs during the reporting period, "No Discharge" shall be reported.

The DMR forms will be filled out accurately and completely in accordance with requirements of this permit and the online netDMR guidance documents and applicable trainings. . They will be electronically signed and submitted by an authorized member of the SWMP Administrative Team (see Section 5.2). Schedules and procedures for sampling are as follows:

| Sampling Location | Pollutant Parameters to be Sampled | Monitoring Schedule | Numeric Limitations |
|---|---|---|---|
| Outfalls 001A, 002A, 003A | Flow, in million gallons per day, 50050 | Continuous[1] | 2.88 (30-day avg)<br>Report (daily max) |
| | pH, (Minimum-Maximum), 00400 | 2 days per month | 6.5 to 9.0 (daily maximum) |
| | Oil and grease, in milligrams per liter[2], 03582 | 2 days per month | 10 (daily maximum) |
| | Total suspended solids (TSS), in milligrams per liter, 00530 | 2 days per month | 30 (30-day average)<br>45 (7-day average) |
| | Total Flow, in million gallons, 51500 | Continuous[1] | Report (Qrtr Total) |
| | Copper Dissolved, in ug/L, 01323 | 2 days per month, grab | Report (30-day average, daily max) |

[1] "The chronic flow limit is equal to the flow rate provided in the permit application, and will be stated on the certification. If power is not available, flow may be measured on an instantaneous basis.

[2] If a visual sheen is noticed, the facility will collect a grab sample for oil and grease.

A schedule of events has been placed on Stormwater Reporting Requirements.

| ICIS Code | Description | Due Data | Frequency |
|---|---|---|---|
| 00308 | The permittee shall submit an annual report to the division for the reporting period January 1 through December 31. | February 28 | Annual (9) |

The procedures used to perform the above monitoring:
Visual Monitoring
Benchmark Monitoring
Water Quality Standards Monitoring
Additional Monitoring as Required by the Division

## 13.2 FLOW MONITORING

A flow monitoring device has been installed on all of the facility's applicable permitted process water outfalls.

### 13.3 ANNUAL REPORT

The facility will submit an Annual Report, covering January 1 through December 31 of each year, on the overall compliance of the facility. The Annual Report will contain, at a minimum:

- The name of facility, address, phone number, and permit certification number.
- A report on the facility's overall compliance with the SWMP.
- A summary of each comprehensive stormwater facility inspection made, including date, findings, and action taken.
- Results and interpretation of any stormwater monitoring performed.

The report will be signed and certified for accuracy by the SWMP Administrator (see Section 5.2), including the certification language contained in the "Signatory and Certification Requirements" of the General Permit.

The Annual Report will be due to the Division on or before February 28 of each year, after the first full year of coverage under the permit. It will be sent to:

Colorado Department of Public Health and Environment
Water Quality Control Division
WQCD-P-B2
4300 Cherry Creek Drive South
Denver, CO 80222-1530

## 14 NOTIFICATION REQUIREMENTS

The SWMP Administrator will oversee all notifications; if the SWMP Administrator is not available, he or she will designate a member of the SWMP Administrative team as an alternate to make any necessary notifications (see Section 5.2).

All notification requirements under this section will be directed as follows:

1) **Oral Notifications, other than for spills**, during normal business hours will be to:

Water Quality Protection Section – Industrial Compliance Program
Water Quality Control Division
Telephone: (303) 692-3500

2) **Spills notifications** at any time and **other notifications** after hours will be to:
Emergency Management Program
Laboratory and Radiation Services Division
Telephone: (877) 518-5608

**Written notification** will be to:
Water Quality Protection Section – Industrial Compliance Program
Water Quality Control Division
Colorado Department of Public Health and Environment
WQCD-WQP-B2

4300 Cherry Creek Drive South
Denver, CO 80246-1530

## 14.1 CHANGE IN DISCHARGE

The facility will notify the Division regarding changes in discharge under the following circumstances:

- The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged, OR
- The alteration or addition could significantly change the facility's sludge use or disposal practices, and such alteration, addition, or change may justify application of permit conditions that differ from or are absent in the existing General Permit, including notification of additional use or disposal facilities not reported pursuant to an approved land application plan.

The facility will give advance notice to the Division of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

Whenever notification of any planned physical alterations or additions to the permitted facility is required pursuant to this section, the facility will furnish the Division such plans and specifications which the Division deems reasonably necessary to evaluate the effect on the discharge, the stream, or groundwater. If the Division notifies the facility that such new or altered discharge might be inconsistent with the conditions of the permit, facility will prepare a new or revised permit application and shall follow the procedures specified in Sections 61.5 through 61.6, and 61.15 of the Colorado Discharge Permit System Regulations.

## 14.2 SPECIAL NOTIFICATIONS – DEFINITIONS

***Bypass***: Intentional diversion of waste streams from any portion of a treatment facility.

***Severe Property Damage***: Substantial physical damage to property at the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. It does not mean economic loss caused by delays in production. PART II Page No. 19 Permit No. COG-500000

***Spill***: An incident during which flows or solid materials are accidentally or unintentionally allowed to flow or escape so as to be lost from the treatment, processing, or manufacturing system, and which may cause or threaten pollution of state waters.

***Upset***: An exceptional incident during which unintentional and temporary noncompliance with permit effluent limitations occurs because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

## 14.3 NONCOMPLIANCE NOTIFICATION

The facility will report the following circumstances **orally within 24 hours** and in **written form within 5 days** from the time it becomes aware of the following circumstances:

- Circumstances leading to any noncompliance which may endanger human health or the environment regardless of the cause of the incident.

- Circumstances leading to any unanticipated bypass which exceeds any effluent limitations in the permit.
- Circumstances leading to any upset or spill which causes an exceedance of any effluent limitation in the permit.
- Daily maximum violations for any of the pollutants limited by Part I.A of this permit and specified as requiring 24-hour notification. This includes any toxic pollutant or hazardous substance or any pollutant specifically identified as the method to control any toxic pollutant or hazardous substance.

The facility will report instances of non-compliance which are not required to be reported within 24 hours when DMRs are submitted (see Section 13.1).

In all cases, written notifications will include the following information:

- A description of the discharge and cause of noncompliance.
- The period of noncompliance, including exact dates and times and/or the anticipated time when the discharge will return to compliance.
- Steps being taken to reduce, eliminate, and prevent recurrence of the noncomplying discharge.

## 14.4 OTHER NOTIFICATION REQUIREMENTS

The facility will notify the Division, in writing, 30 days in advance of a proposed transfer of permit as provided in the "Transfer of Ownership or Control" requirements in the General Permit.

The facility will notify the Division as soon as it knows or has reason to believe any of the following General Permit items are applicable to the facility:

- That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant not limited in the General Permit, if that discharge will exceed the highest of the following "notification levels":
    - A concentration of 100 micrograms per liter (µg/L) for constituents not otherwise specified
    - 200 µg/L for acrolein and acrylonitrile
    - 500 µg/L for 2.4-dinitrophenol and 2-methyl-4.6-dinitrophenol
    - 1 milligram per liter (mg/L) for antimony
    - Five times the maximum concentration value reported for any pollutant in the permit application in accordance with Section 61.4(2)(g). PART II Page No. 20 Permit No. COG-500000
    - The level established by the Division in accordance with 40 CFR 122.44(f).
- That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant not limited in the General Permit, if that discharge will exceed the highest of the following "notification levels":
    - A concentration of 500 µg/L for constituents not otherwise specified

- 1 mg/L for antimony
- Ten times the maximum concentration value reported for that pollutant in the permit application
- The level established by the Division in accordance with 40 CFR 122.44(f).

Reporting forms are included in Appendix B.

# APPENDIX A

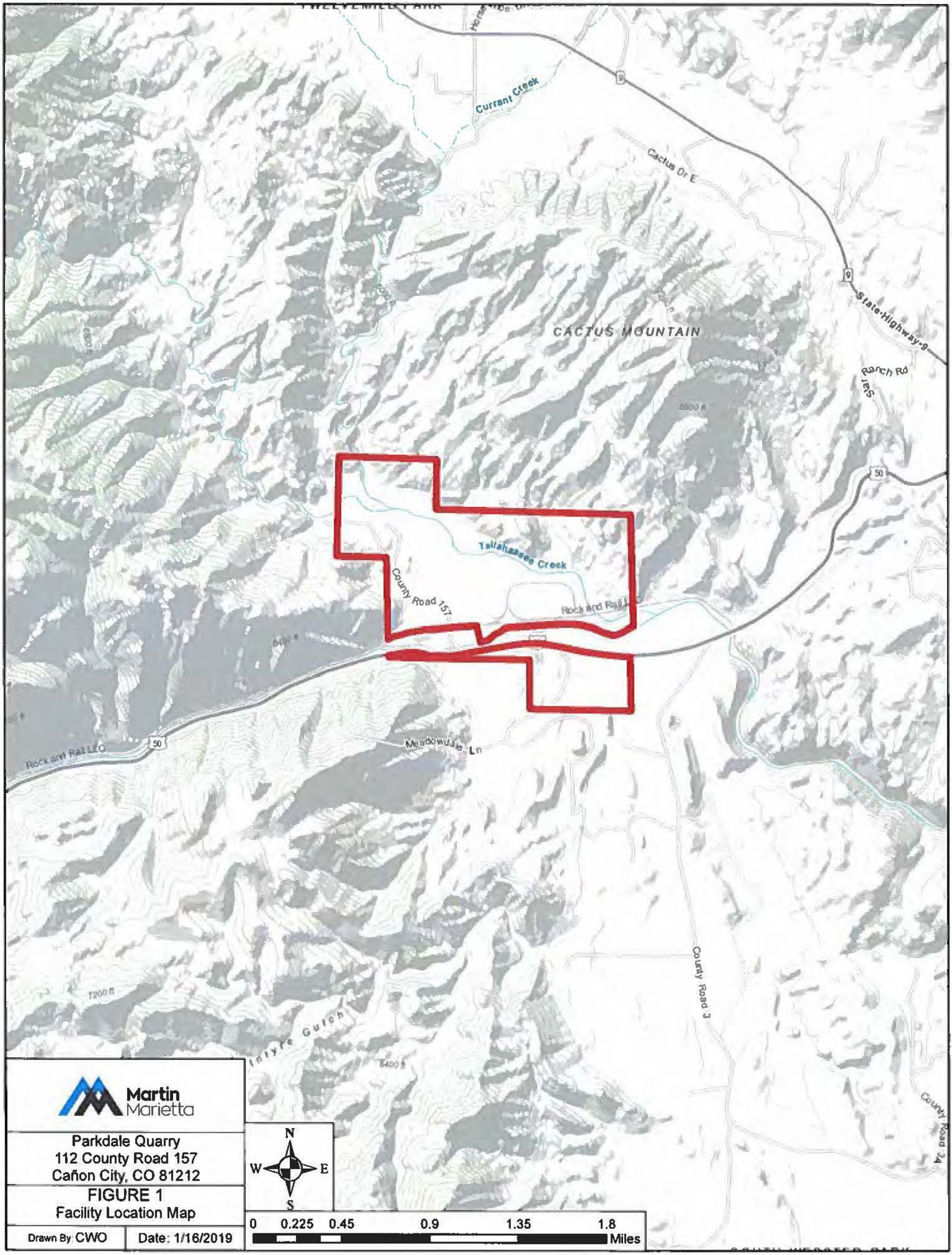
# FIGURES

**FIGURE 1 FACILITY LOCATION**

**FIGURE 2 FACILITY LAYOUT**

# APPENDIX B

# REPORTING FORMS

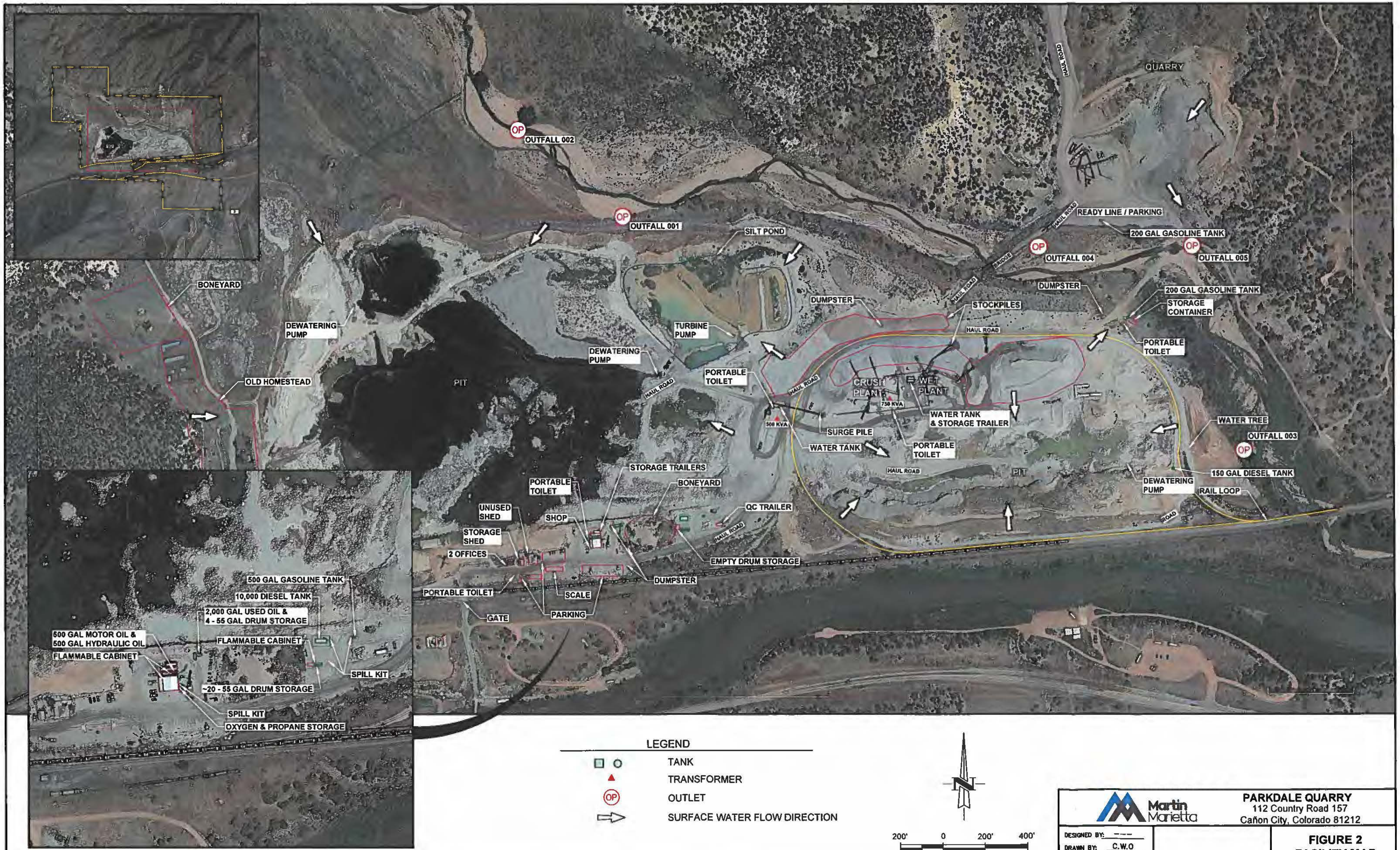


Martin Marietta

Parkdale Quarry
112 County Road 157
Cañon City, CO 81212

FIGURE 1
Facility Location Map

Drawn By: CWO
Date: 1/16/2019



**PARKDALE QUARRY**
112 Country Road 157
Cañon City, Colorado 81212

DESIGNED BY: ---
DRAWN BY: C.W.O
DATE: 01/22/2019

**FIGURE 2**
**FACILITY MAP**